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Utilizing the principles and strategies of brain based learning in educating the deaf

Cynthia Grassel Szabados

UTILIZING THE PRINCIPLES AND STRATEGIES OF BRAIN BASED LEARNING IN EDUCATING THE DEAF

A Project

Presented to the

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By

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Approved by:

[redacted]

Dr. Robert London, First Reader
Faculty Supervisor

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Date

[redacted]

Dr. Samuel Crowell, Second Reader

ABSTRACT

The purpose of this project was to address the need for integrating brain-based principles and strategies into existing curriculum for deaf students. The strategies of brain-based learning were used to create more meaningful lessons tailored to Deaf students.

One product of this project is an interdisciplinary teacher checklist that will enable any teacher of any subject being taught to deaf students to identify and integrate a variety of strategies which are effective in brain-based learning to better facilitate the educational process of all deaf learners, and to meet the needs of each and every deaf student.

A curriculum unit outline was designed and tried in the classroom to further assist teachers with curriculum planning, and has been included within this project.

ACKNOWLEDGMENTS

Most important, a sincere and heartfelt "thank you" goes to my husband Sandor, for his encouragement, patience, and faith in completing my project. I thank him for his valuable input and suggestions; he was my "first" reader assisting me in helping the words flow. I thank my children, Sandor Jr. and Alycia, for their patience while Mommy worked on her project. Many thanks to Uncle Lanny and Grandpa Al who gave up their time to baby-sit for my children while I was finishing this project. I will be forever grateful to all of you!

I would like to sincerely thank Dr. Sam Crowell for the inspiration instilled in me to conduct my research on brain-based learning. His classes inspired me to become a better teacher for my deaf students.

I would like to give special thanks to Dr. Bob London for his expert guidance throughout my two years as a graduate student and his assistance in completing my project.

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CHAPTER ONE

INTRODUCTION

This project was designed to integrate the brain based principles and strategies into an existing curriculum being used in a science classroom for deaf students. The goal of this project was to develop a checklist that teachers can utilize when integrating the brain-based principles and strategies into their classrooms in order that the curriculum be revised to promote student centered, brain-compatible curriculum.

I wanted to escape from the traditional linear methods of teaching that disregard individual student learning styles and preferences and shift to a multi-directional, brain-based method that would elevate the quality of learning experiences for deaf students. I also wanted to integrate effective strategies which would enable my limited English proficient deaf students to become proficient in acquiring content knowledge without depending on textbook and lectures to "factory feed" the students. Brain-based research in education suggests guidelines for how to improve teaching practice and enhance individual student learning.

My interest in brain-based learning stems from the past year of classes I have taken in the interdisciplinary studies, integrative studies option in education MA program. Prior to that time, I was not familiar with the groundbreaking research that has been occurring in relation to brain-based teaching. However, while pursuing my BS degree, I recall studying the various psychological findings on cognitive learning such as: Erikson's levels of cognitive learning, Piaget's theory of cognitive development, Bloom's Taxonomy of the cognitive domain, as well as Maslow's hierarchy of learning. I do not recall information on how the brain itself processes and "learns" information. This is a field of interest that struck me right away since I always strive to find methods and techniques that will enhance the learning of my deaf high school students. Understanding what brain-based learning entails will give teachers who teach the deaf a chance to open up the classroom to a new realm of learning that allows deaf students to really "get something" out of their learning. In my opinion, understanding the process of how the brain works as much as we can is crucial for today's teachers.

My interest in brain-based learning comes from the frustrations I have experienced as an educator for the deaf students in the last 11 years. I have made specific observations over the years concerning what typically happens and works or does not happen and does not work while teaching deaf students. Because most deaf students, in my setting, possess minimal reading skills, typically below third grade level, I have struggled with motivating the students' learning via traditional modes that use printed text and written tests. Based on experience, as to what works or does not work, I have tried many different curriculums and methods in an attempt to reach out to my low reading deaf students'. My hope is that using some or all of the brain-based principles and strategies will produce motivated and inspired deaf learners.

In an increasingly stressful teaching environment, teachers are expected to raise the expectations of our deaf students who, for the most part, do not read past a fourth grade level; follow standards based education from the state; adhere to specified curriculum assigned by our schools; as well as prepare our students for the High School Exit Exam. These factors prove to be challenges to quality teaching. This project suggests that integration

of the brain-based principles can be an effective tool for teachers under these conditions.

In chapter two, the literature review, I will explain the various literature reviewed regarding parts of the brain, how the brain works, how the brain learns, sensory preference, learning styles of students, hemispheric dominance in learning, thinking skills and brain-based learning. In addition, literature was reviewed related to the field of education for the deaf. This literature includes the history of deaf education, the field of education and neuroscience and its implications on teaching, the brain and language, psycholinguistics, and ASL (American Sign Language) and English literacy.

Chapter three will discuss the methodology which will clearly explain that the purpose of this project is to develop a process for planning units consistent with the needs of deaf students with low reading levels, resulting in an end product of a teacher checklist for planning learning opportunities and a student questionnaire to evaluate the effectiveness of the process.

Chapter four will evaluate all of the materials reviewed from the literature review in addition to identifying relevant information about the context of how this project

was set up and information on the school where this project occurs, the students who were involved in this project, and the classroom and setting used. In addition, concluded data will be summarized.

Chapter five will be used to explain the conclusions and results of this project as well as providing practical suggestions and implications of integrating brain-based principles and strategies into existing curriculum for deaf students.

CHAPTER TWO

LITERATURE REVIEW

This chapter will review pertinent literature concerning the following topics: Parts of the brain and how the brain processes information; sensory preference, learning styles, and hemispheric dominance in learning; thinking skills and brain learning; educating the deaf; education and neuroscience; the brain and language; psycholinguistics; ASL and English literacy.

Parts of the Brain and How the Brain Processes Information

Before one can understand how the brain processes and utilizes information, one must understand the basic physiology of the brain and the cognitive functions of those parts. The smallest and most primitive system of the brain, the brain stem, is considered the "automatic reflex brain". The brain stem controls involuntary body functions such as breathing, digestion, and the heart rate. The cerebellum controls muscular activity and balance. (Parnell, 1996).

The second part of the brain, the limbic system, includes the hippocampus, thalamus, hypothalamus, and the

amygdala. This is considered the "memory brain" since it is concerned with memory, emotions, and motivation. The hippocampus plays a large role in memory-related learning, the thalamus relays information from the senses to the cerebral cortex, the hypothalamus controls sexual urges and other motivation, and the amygdala controls anxiety and fear (Parnell 1996).

The third part of the brain, the cerebrum, consists of the cerebral cortex and nerve fibers. This is considered the "thinking brain" because it controls and connects the higher functions of learning, judgment, and intelligence (Parnell, 1996)

The brain's interconnections exceed our imagination by an astronomical number. The brain has approximately 100 billion neurons, and each neuron has one to 10,000 synaptic connections to other neurons. Our brains consist of interdependent networks that are all connected in some way or another. It is amazing to know that any information already stored influences what we learn and how we learn (Weiss, 2000).

No two brains think alike, every neuron serves as a relay station. Neurons receive and send information through the synapses. From the synapses, the

neurotransmitters cause the signals to flow from one to the other. This process is the basis for all human behavior. When new stimuli are introduced via new experiences and exposure, branches of dendrites grow to receive input from as many as 20,000 other neurons. When used, you grow new dendrites, and when impoverished, you lose them. If you don't use it, you lose it!! (D'Arcangelo, 1998)

In the last ten years, known as the decade of the brain, scientists, using technologies such as MRI's, fMRI's, and Pet scans, have explored how the human brain processes memory, emotion, attention, patterning, and context (Weiss, 2000). There is a vast array of videos and literatures which depict the use of such neurological scans on the brain, and depict memory loss in human patients who have used various street/recreational drugs in the past or those elderly persons who are suffering from Alzheimer's disease (Weiss, 2000).

The brain processes information in a relatively organized way. Depending on the sensory input, there is a hierarchy of responses to which the brain responds. Input that affects survival takes top priority while emotional input and input for new learning takes lower levels of priority. Sensory input that has higher priority

diminishes the lower priority input. Sensory input is collected from the environment through our five senses. It is interesting to note that all five senses do not contribute equally to our knowledge base. Most people do not use sight, hearing, and touch equally during learning (Sousa p. 23). This explains why we, as humans, prioritize our survival over learning. Often times, when someone is placed in a high stress situation, the stress hormones that are released inhibit cognitive functioning and long-term memory that causes a phenomenon called downshifting (Caine and Caine, 1991). Downshifting occurs often in our classrooms when stressful stimuli are introduced such as quizzes, mid terms and final exams.

The Caines (1991 and 1998) have made research available to educators in a synthesized form from the fields of neuroscience, physiology, optimal performance studies, neuropsychological, stress management, and psychology and more (Crowell, Caine, Caine, 1998, p. 7-10). They identified twelve brain-based principles that can be used to help teachers understand how a student processes information:

1. The brain is a complex adaptive system
2. The brain is a social brain

3. The search for meaning is innate
4. The search for meaning occurs through patterning
5. Emotions are critical to patterning
6. Every brain simultaneously perceives and creates parts and wholes
7. Learning involves focused attention and peripheral perception
8. Learning always involves conscious and unconscious processes
9. We have at least two ways of organizing memory
10. Learning is developmental
11. Complex meaning is enhanced by challenge and inhibited by threat
12. Every brain is uniquely organized.

I will address the implications of these twelve principles in more detail later in chapter four in which I outline how these principles influenced the development of the teacher checklist used to develop the sample curriculum unit for this project.

In addition the to twelve brain-based principles offered by the Caines, there are several implications of brain-based learning that teachers need to keep in mind

when planning an effective brain-based curriculum unit, they are:

1. Teachers need to understand that cognitive and brain growth of our students are resilient and plastic when adequate environments are provided to them.
2. It is pertinent for teachers to realize that the brain relearns and reworks skills and concepts not once but successively until the optimum level of learning is reached.
3. Teachers should know that all students have multiple levels of skill and understanding, and that their skills and concepts vary across a wide range of levels.
4. To prevent a rapid drop in understanding, teachers must provide contextual support for high-level functioning.

Teachers must provide supportive situations to students who are at lower levels as well as to students at optimal levels to encourage independent learning and thinking which normally occurs at lower levels. (Fischer & Rose, 1998, pg. 60).

Sensory Preference, Learning Styles, and Hemispheric Dominance in Learning

Each person develops preferences for certain senses as they gather information from their environment. Those who prefer to learn through sight are called "visual learners," those who prefer to use their hearing are known as "auditory learners," and those who prefer to use their sense of touch or whole body involvement in the learning process are called "kinesthetic learners" (Sousa, 1995).

It is important for a teacher to understand the three modalities of learning styles. With this information, teachers can then understand why students behave differently than one another during an instructional lesson. The teacher must also recognize that typically they teach the way they have learned. This explains why teachers who use more visual strategies in their classrooms are many times visual learners themselves. The students who are visual learners will tend to learn more from this teacher than those who are strong auditory or kinesthetic learners, while at the same time, the auditory and kinesthetic learners may become frustrated with the teacher and act out through misbehaviors or lack of attention to the teacher. A teacher's learning style and sensory

preference can affect his/her teaching and the students learning. To increase effectiveness of a lesson, it is important to address all sensory preferences and learning styles.

One can presume that it is impossible to adapt to every single student's learning styles and preferences, therefore, an educator must research all possible venues of learning styles and learning preferences, to make possible an enhanced education for all students involved.

In addition to research on the three learning styles, tests have been done on the hemispheres of the brain to understand the functions of the right and left sides of the brain and the implications for learning. Anesthetizing one hemisphere, conducting PET scans, electroencephalographs (record electrical impulses), and hemispheric specific vision and hearing tests are the various tests used to record data concerning the left and right brain. From these various tests, scientists have concluded that most people have a dominant hemisphere. People whose left hemisphere is dominant tend to be more verbal, analytical, and good problem solvers, while right hemisphere dominant people tend to be good at math, be artistic, and deal with the visual world more easily (Sousa, 1995, p. 87).

During learning, both hemispheres are engaged, depending on what is being taught, the hemisphere with the specialization of a specific skill exchanges the information with the opposite hemisphere. When a task involves both hemispheres we are able to fully participate in an activity. However, when there are two activities that each engages a different side of the brain, the task becomes very difficult since the functions interfere with each other (Pinkerton, 1994).

This research suggests that teachers should design lessons that include activities that introduce concepts verbally and visually to encourage learning that involves both hemispheres so that students can integrate the new learning into meaningful information. Such activities may include visualized note taking, concept mapping, and the use of imagery (Bell, 2002).

Many schools today consist of a structured environment with time schedules that teach facts and rules rather than patterns, and are very verbal in nature; therefore, tend to favor left hemisphere dominant learners. Danesi (1990) states that schools are over emphasizing the verbal and analytical skills while neglecting the non-verbal forms of communication that would be most likely to lead to deeper

understanding of the language and its structure (Sousa, 1995, p. 95).

With respect to gender, it is interesting to note that in Jerre Levy's research (Sousa, 1995), females tend to be left hemisphere dominant and do much better in school than their right hemisphere dominant male counterparts. The saying "women are from Venus, men are from Mars" may be meant to help us to understand the hemispheric learning/thinking differences between men and women!

Subjects in our schools have a tendency to favor either the right or the left hemispheres. Arithmetic requires left hemisphere processing since it is linear and logical, typically having only one answer to each problem. Learning a second language is a left hemisphere subject since it involves aspects of language (grammar and phonetic). Algebra and Geometry are right hemisphere centered courses that involve holistic solutions, relational solutions, and multiple solutions. Science is a right hemisphere centered subject since it involves collecting information and data and making inferences based on data. It is also intuitive, creative, and relational. What is disappointing about our schools today is that science tends to be taught as a fact memorization subject

that tends to be a left hemisphere dominant task. This reinforces the fact that our traditional schools tend to favor the left hemisphere dominant learners (Sousa, 1995).

Thinking Skills and Brain Learning

Many teachers today realize that students do not think as critically as they should in order that they may become more successful in a world that is constantly changing and becoming technologically complex. However, does this mean that students cannot think? We are each born with a brain that has all the sensory components and neural organization necessary to survive and live in our environment. According to brain based research there are three messages for educators: 1) The early years of a child's life, when many neural connections are made, are more critical than ever thought before. 2) Hands on sensory learning are crucial to making neural connections that will be useful throughout life. 3) Safe learning environments are essential for children to reach their potential (NEA Today, 1997). It is also known that our experiences condition our brain and our brain helps condition our experiences (Parnell, 1996). Therefore, the more experiences that students have in their learning, the more it allows them to

connect with past and present experiences, thereby allowing for brain based learning to occur.

As our students change both physically and psychologically, it is important to remember that students who come from an enriched home environment seem to have an increased ability to learn. Physical structures of the brain can change as a result of experiences and can have a positive impact on brain development and knowledge retention (Parnell, 1996).

When one experiences something that they can connect with a previous experience, the memory of this experience will become engrained in the brain. On the other hand, if an experience is not meaningful, there is nothing that allows this experience to become memorable.

Our innate thinking abilities to process learning at higher levels of complexity comes from childhood. For the normal child, there is a natural, inborn, and instinctual curiosity for learning through exploration, handling objects, creeping, walking, imitating, talking, drawing, etc. This curiosity is hampered when a child enters a school where the emphasis tends to be on listening, memorizing, and other passive learning processes. Finding meaning in what we are learning is a strong motivational

force in the life of every human being. Teachers need to look at helping students connect their subject matter with the context of meaningful application (Lowery, 1998). In this sense, teachers do not teach students how to think, but rather how to organize content in a way that facilitates and promotes higher order thinking. Unfortunately, when attempting to raise student-thinking skills, many teachers tend to increase the difficulty in a lesson rather than the complexity of the lesson (Chance, 2001).

In "How the Brain Learns (Sousa, 1995)," we re-visit Blooms Taxonomy of the Cognitive Domain. Bloom's levels of cognition are organized from decreasing order of complexity to more complex levels of learning, which is useful when moving students from lower level thinking skills to higher levels of thinking skills. The brain learns naturally from experience. As one goes through life, we used these past experiences as building blocks or stepping-stones for new information. Our past learning experiences allow our brain to imprint the newly learned information into the brain. The six levels of Bloom's domains are: Evaluation, Synthesis, Analysis, Application, Comprehension, and Knowledge. Most teachers are familiar

with Bloom's approach thus making it easier to implement into a classroom situation. This model motivates teachers who are using Bloom's Taxonomy correctly because they see their students learning better and thinking more profoundly, as well as showing more interest in their academic subjects. Experiential learning is important in both Bloom's taxonomy and in brain-based learning.

Educating the Deaf

From the eighteenth century to the present day, education tended to bring the deaf together, empower them, foster their language and promote the development of their culture, then, tragically since 1860 deaf education has tended to oppress, disempower, and disable them (Lane 1984; Lang and Stokoe 2000).

In 1837 the Reverend Thomas Gallaudet together with a French deaf teacher named Laurent Clerc established the first school for the deaf in America. Children at the school were taught in a "combined method" using American Sign Language (ASL) and speech. There was a broad acceptance of deaf teachers and deaf administrators being involved in the education of deaf children at that time. The residential schools for the deaf that opened in the

1840's, along with the societies of learned deaf people that developed around them, became the "garden of Eden" for today's deaf culture (Lane and Grosjean, 1980).

This combined approach was standard in educating the deaf until 1860, when the "oral method" began to gain acceptance. This method requires the child to learn to speak and speech read exclusively. Many parents preferred this method; however, most profoundly deaf children do not learn how to speak intelligibly nor are they able to speech read effectively with this approach. These children often times were made fun of and thought of as "inferior." Children who failed in this method were considered less than normal by the general society and put into manual signing programs, which were considered inferior by mainstream society. The period between the 1860's and the 1960's has been referred to as the "Hundred Years' War" because of the enduring struggle between oral English proponents and manual signed language proponents (Drasgow 1998). "The congress, considering the incontestable superiority of speech over signing in restoring the deaf mute to society, and in giving him a more perfect knowledge of language, declares that the oral method ought to be

preferred to that of signs for the education of the deaf and dumb." (Drasgow, 1998 pg. 331).

In the 1970's PL 94-142 was passed, insuring that all handicapped children could attend school in their local school district. This meant integration for most children with disabilities; however, this meant further language isolation for deaf children (Foster, Barefoot, et al. 1989).

A positive development was the resurrection of residential school programs for the deaf that emphasized the foundation through which deaf children learned language both in the classroom and outside of the classroom. Dorm staff signed to students and children could sign to each other on the playground. Children of deaf parents and deaf staff transmitted the essential elements of language (Padden and Markowicz 2000). This is essentially the best and least restrictive environment for most profoundly deaf children.

In contrast to the positive developments and pedagogy during the period of residential settings, hearing educators and administrators, seemingly devised systems concerning how language would be developed by setting up programs of "visual English": sign language systems with

made up signs, which supposedly would resemble and account for all the English syntax that was "missing" from ASL. Many times, this method was now taught to teachers over summer break and the teachers were then expected to be signing every word they say in addition to clear articulation (Johnson and Erting, 1989). It is virtually impossible for teachers to be able to learn in one summer what they might expect their students to learn in relation to sign language acquisition without formal instruction. Many students who were in programs such as these became pseudo-lingual, having no firm foundation in either visual spoken English, signed English, or ASL (Kannapell, 1989).

Studies indicate that the area in which the deaf child is weakest, and which seems to underlie his/her deficiency in other areas, is his/her language ability. Studies of academic achievement indicate that the lowest scores of the deaf child are in the area of word meaning and paragraph meaning subtests. For example, the median reading achievement score for the deaf at age 16 has been reported to be grade 3-4 (Moores, 1997).

To address this issue, there are varied approaches to teaching the deaf today. There are programs in school districts which encourage mainstreaming the deaf into a

hearing classroom with an interpreter, self-contained classrooms for the deaf in public schools, residential schools for the deaf, and private day programs which may either advertise an oral method or a total communication method. Traditionally, adherence to a particular philosophy has driven the selection of educational approaches for deaf children. An area that is begging for future research is to develop a philosophy that can and should be based on empirical research, and that is able to correlate student characteristics with educational approaches and predict or compare outcomes (Drasgow, 1998). This would enable parents and educators to make data based decisions, as well as philosophical choices regarding selecting an approach of educating the deaf child.

Many educators and parents have their opinions on what deaf education should entail. Recently, it has been argued that ASL should be the first language of deaf children and that English should be taught as a second language. Drasgow (1998) recommended potential ways in which ASL could be exploited for intentional and systematically developing English literacy skills in those children for whom ASL is the best language option. They are as follows:

1. Children need to master the conversational form of ASL and internalize it.
2. ASL should be the language of instruction, at least initially, because children have mastered its conversational form.
3. ASL can then be used to develop emerging literacy skills. Activities to enhance this would include finger spelling to English letter recognition, drawing, and using pictures to represent signs and their corresponding written words, and frequent use of interactive ASL storybooks.
4. Deaf children would benefit from systematic instruction to learn the structure of ASL just as hearing children benefit from instruction to learn the structure of English. Deaf children would learn the phonology, morphology, and syntax of ASL. This instruction would familiarize these children with the grammatical aspects of their conversational language. One section of the bridge from ASL to English literacy could then be relating the phonology of ASL to the phonology of English to facilitate learning of the grammatical structure of English. Other sections could include relating the morphology and syntax of ASL to similar domains of English. Formal instruction in the structure of ASL would allow students to understand similarities between ASL and English at specific grammatical levels of structure, rather than expecting an "intuitive" understanding of the structure of English because they have fluency in the conversational form of ASL.
5. Beginning reading instruction in English would rely heavily on an interactive approach, while the language of instruction would continue to be ASL. The interactive approach emphasizes the simultaneous development and coordination of both letter and word knowledge, and real-world knowledge. (Drasgow, 1998, pg. 330).

Of course, research needs to be completed to evaluate the effectiveness of the above recommendations in order

that a bridge can be built piece by piece, on solid footing, with beneficial and predictable outcomes (Drasgow, 1998).

What practical implications do research and findings completed on normal hearing children have for developing language skills for the deaf? It is pertinent that continuing growth of knowledge regarding the phenomenon of language development exerts influence on programs for the deaf. Moores (1997) discusses five major areas which deserve attention from professionals in deafness. They are as follows:

> Optimal Period: This is a critical period, usually between the ages of 3-4 in which language can be acquired. During this period children learn language faster than adults. Any program initiated after age of 5, no matter which methods are used, will fail for the majority of deaf children. As soon as hearing loss is diagnosed, it is important for children to receive language instruction. A child that is disciplined but not reasoned with, who has no answer to his questions, who has no control over and little understanding of his environment, starts with a deprivation that may never be overcome.
> Teaching and Learning: The most efficient approach is to provide the young deaf child with a language environment in the home as close as possible to that enjoyed by the hearing child. The role of the parents of a deaf child should be that of learning facilitators, not teachers.
> Language and Speech: Teachers need to treat speech and language as separate entities. The primary goal of education must be language, not its subsidiary skills. The establishment of

> language is not dependant on phonics. Language should include graphics (reading, writing, finger spelling, and signs), which should be introduced at the earliest possible time
> Performance and Competency: Language competency lies in the deep structure, in the ability to generate novel yet appropriate utterances on the basis of a limited vocabulary and knowledge of the rules of the language. The rules by which the child is producing the unacceptable patterns need to be altered. The inappropriate generative patterns must be supplemented by more commonly accepted ones. To develop methods for accomplishing this is a forbidding task fraught with pitfalls, but it must be done.
> Imitation and Expansion: It is logical that child imitation and parental expansion are necessary in the development of language competence. However the absence of such a mutually intelligible communication system between a hearing parent and their deaf child greatly limits or even precludes the development of linguistic abilities. (Moores, 1997, pg. 82).

What is most interesting is that for imitation to occur, the child must be exposed to consistent, understandable grammatical patterns and for expansion to occur, the system must provide for the child to frame his utterances in a manner understandable to the parents and enable the parents to supply appropriate patterns. Perhaps it has been the lack of this grammatical response dependent system, which has led to so many functionally illiterate, and alinguistic deaf children (Moores, 1997).

Education and Neuroscience

Researchers in neuroscience caution educators to resist the temptation to adopt policies on the basis of a single study or to use neuroscience as a promotional tool for a program. There is so much research that needs to be completed before the results of neuroscience studies can be used in the classroom. Brain research does not, and may never explain what strategies will work in the classroom to increase student understanding (Bell, 2002). Most of the research being conducted concerning the brain is simply studies on how the brain functions. It is important to read, understand and analyze research literature in order that an educator may develop a functional understanding of the brain and its processes. In this manner, educators are in the best position to know how the research does or does not supplement, explain, or validate current practices being used in education today (Wolfe and Brandt, 1998).

Bellugi (1999) states that sign languages provide a powerful tool for investigating the neurobiology and cognitive architecture of human language. This is due in part to the fact that ASL depends upon high-level vision and motion processing systems for production, and it

requires the integration of motor systems involving the hands and the face.

The term neural plasticity- the brain's amazing ability to constantly change its structure and function in response to external experiences was coined in the process of research conducted by Marian Diamond at the University of California at Berkeley in the 1960's. Her research team determined that brain structures are modified by the environment. Another amazing finding from Diamond's research is the fact that dendrites, the connections between brain cells, can grow at any age. Knowing this should enable educators to foster the growth of dendrites rather than letting them wither and die. The classroom is not a "neutral" place; the trick is knowing what constitutes an enriched environment. (Wolfe and Brandt, 1998).

Wolfe and Brandt (1998) emphasize four findings in relation to the brain. These findings can assist educators in creating lesson plans that are consistent with brain research. The four findings are as follows:

Finding One: The brain changes physiologically as a result of experience. Environment affects how genes work, and

genes determine how the environment is interpreted, specifically,

> A) The brain has not evolved to its present condition by taking in meaningless data; an enriched environment gives children the opportunity to make sense out of what they are learning, what some call the opportunity to "make meaning."
> B) The brain develops in an integrated fashion over time. We do not expect babies to talk in one week, tie their shoes the next, and then work on their emotional development. An enriched environment addresses multiple aspects of development simultaneously.
> C) The brain is essentially curious, and it must be to survive. It constantly seeks connections between the new and the known. Learning is a process of active construction by the learner, and an enriched environment gives children the opportunity to relate what they are learning to what they already know.
> D) The brain is innately social and collaborative. Learning is enhanced when the environment provides students with the opportunity to discuss their thinking out loud, to bounce their ideas off their peers, and to produce collaborative work. (Wolfe and Brandt, 1998, pg. 10).

Finding Two: IQ is not fixed at birth. Experiences shape our IQ and are ever-changing as our learning experiences develop.

Finding Three: Some abilities are acquired more easily during certain sensitive periods, or "windows of opportunity."

Finding Four: Learning is strongly influenced by emotion.

The Brain and Language

Lesion and Functional Magnetic Resonance Imaging

(fMRI) studies depict the left hemisphere, specifically the inferior frontal cortex, as the dominant side of the brain responsible for language processing, independent of modality. Most of our understanding of the neural bases of language is derived from the studies of spoken languages (Bavelier, Corina, and Neville, 1998). This fact, based on spoken language, limited researchers to infer the determinants of left hemisphere specialization for human language; that is, until sign language came into the picture. Just as there are many spoken languages, there are many unique and different sign languages used by the deaf all over the world. Many people assume that ASL is a universal language, this is not true. Each country has their own unique signing system. In fact, you will even find "dialects" of sign language depending on which part of the United States you are. Signers from the East Coast may have a different sign for a specific word than a signer who is from the West Coast. For example, the word "cake,": on the East Coast it is signed with one hand near the face; on the West Coast it is either finger spelled or signed using both hands (Charrow and Wilbur, 1975).

ASL integrates both language and visio-spatial properties. The left hemisphere language areas are recruited by the language system independently of the modality and surface properties of the language, suggesting that these areas are biologically determined to process the kind of structure specific to natural language. (Bavelier, Corina, and Neville, 1998). The right hemisphere is the area of the brain where most visio-spatial processing occurs. It is possible then that sign could be processed bilaterally, or more in the right hemisphere of the brain due to ASL's spatial nature. So the question is, is ASL processed mostly in the right brain or equally processed in both sides of the brain? When researchers compared brain systems for signed and spoken languages, there were differences. During the comprehension of signed language, studies show a larger recruitment of the right hemisphere areas than in spoken languages. This right hemisphere recruitment shows that the cerebral organization for language can be altered by the structure and processing requirements of the language(Bavelier, Corina, and Neville, 1998).

Bellugi (1999) conducted Positron Emission Topography (PET) scans on deaf people to determine which areas of the

brain responded when subjects were given pictures of famous people and/or animals and were asked to name each stimulus with a signed response. The researchers found that retrieving ASL signs activated neural sites similar to those activated by hearing subjects retrieving English words. Naming famous people activated the left temporal pole, while naming animals activated the right infer temporal cortex, with a trend for more right hemisphere activation for native ASL signers, suggesting some bilateral engagement when retrieving signs for animals (Bellugi, 1999). ASL and spoken language both depend on neural systems in the left temporal lobe. So the conclusion was that sign language, like spoken language is predominantly processed in the left side of the brain (Radetsky, 1994). So when it comes to sign, the visual-spatial/language dichotomy between the right and left-brain doesn't hold. It is also known that some neural networks for signed and spoken languages are shared, and some are not.

PET scans were also conducted to compare patterns of blood flow in the brains of deaf and hearing individuals in response to ASL and spoken language. A study, conducted by Bower (2000), reported that signing deaf people processed

very specific parts of natural language at the same highly specific brain sites as hearing people do. What is interesting to note about this study is the fact that for more than 100 years, those regions of the brain (one near the front of the brain and the other toward the back in the auditory cortex) have been regarded as areas exclusive to perceiving and speaking words (Bower 2000).

PET experiments conducted on deaf people prove that the profoundly deaf, when they use "inner signing", are not using the visio-spatial areas of the right hemisphere, but rather they use the brain area which in hearing people belongs to the language area (left hemisphere) and gets activated when hearing people practice inner speech (Jacobs, 1974).

Does gender make a difference in how a person processes language? An interesting finding from research completed by Ludger Schiffler (2001) explains that the language area in women is generally more distinctly developed than in men. Brocca's area is twenty percent larger in women than men, and Wernicke's area is nearly thirty percent larger. This is consistent with the fact that women tend to have better verbal skills than men. This study was conducted on hearing subjects, but perhaps

it would yield similar results if it were conducted on deaf subjects. Another question that could be posed would be if deaf females have higher reading proficiency scores than deaf males.

In both hearing and deaf children, the capacity for language may well be innate and genetically determined. In the days of old, language was thought to be contingent on the ability to speak (Radetsky, 1994). People who believe that language is innate point out that children are never taught all the rudiments of language; rather, they are exposed to it haphazardly in bits and pieces. If we have an inborn ability, they believe, language lives within us; it seeks only the opportunity to come out, given effective input and appropriate feedback. Laura Ann Petitto (2000), a cognitive psychologist at McGill University in Montreal, gives us evidence that language is innate. She conducted a study on babbling babies. The significance of this research demonstrated that deaf babies born to signing parents babble, with their hands, just like hearing babies babble with their voice. When hearing children born to parents where one parent is hearing and the other parent is deaf, the babies show no preference for speech. They babble in both signs and sounds, they become fluent in both

languages. When hearing babies are born to deaf parents, the children babble in sign and also become fluent in both languages. Petitto's research simply shows that babies grasp the essential structure of language, regardless if it is spoken or signed. There is a predisposition in children to locate and attend to linguistic input regardless of modality. Babbling in either modality serves as a means by which children discover the map between the structure of language and the means for producing this structure (Drasgow, 1998). Humans are born with a mechanism that combs the environment looking for the rhythmic patterns of language, whether these patterns are expressed with the hands or the tongue.

For hearing children, the one word stage of speaking begins around one year of age. ASL signs may emerge somewhat earlier to deaf children of deaf parents and hearing children with at least one deaf parent.

More evidence that supports the innate learning philosophy comes from a study involving deaf children in Nicaragua (Radetsky, 1994). Prior to 1979, these deaf children were isolated and silenced, that is until they were placed in schools for the deaf that had just been established. The children devised a shared set of signs

which had accrued from "home signs," gestures used at home. In essence, they developed their own language to communicate with one another that contained characteristic rules of grammar and a distinct number of hand shape and movement building blocks.

In much of the research that has been conducted, one thing is evident: In the first five years after birth, the brain capacity multiples fourfold. It is possible for children ages zero to five to learn various languages up to an elementary communication level when those languages are consistently being spoken in the child's environment. In homes where children have one deaf parent and one hearing parent, the child will pick up both spoken English and ASL at the same time and with the same type of fluency.

In any language, early acquisition is strongly associated with the left-brain. Neville and Bavelier (1998) states "if you don't learn English until you're 18, you don't show left-hemisphere specialization for English, and if you don't learn ASL until the late teens, you don't show left-hemisphere specialization for ASL. It's dispersed throughout the brain." However, most people learn their primary language during early childhood,

therefore the left-brain bias remains primary, for both spoken and signed language.

In summary, research concludes that early manual communication will not impede the development of communication skills, in fact, deaf children should be introduced to graphics (reading, writing, signs) as early as possible.

Psycholinguistics

In comparison to hearing children, deaf children have significant academic retardation in the areas of language. Educational attainment of deaf children falls far below what might be predicted on the basis of chronological age (Moores, 1997). What is deeply troubling to educators of the deaf today is the fact that in written language, deaf children of 100 years ago were superior to those being graduated or terminated from the schools and programs of today (Moores, 1997)

Moores (1997) stated that many scientists believed that the process of imitation was the primary factor in learning language. Today there is evidence that language does not develop gradually in a child solely by means of parental selective reinforcement. Instead, language

explodes. Language learning is not as passive as was once thought. A child learns language by interacting with it, by actively coping with and manipulating the environment. The child does this on the basis of unsystematic, usually unplanned language input on the part of his/her parents. It also appears that the child develops his/her language through a number of successive, increasingly complex stages, and it is possible that the structures at the earliest most primitive levels are similar for all children no matter what language their parents speak (Moores, 1997) or signs for that matter.

Moores (1997) states that some researchers claim that a child will have acquired all the grammar he/she will ever have by the age of eight, and the bulk of the words that people know are learned before the age of twenty. What is the significance of these principles to deaf educators? The deaf child, who has a history of insufficient input in his/her environment, is at a serious disadvantage in learning language. The advantage that a hearing child possesses over a deaf child is his/her unconscious mastery over phonology and grammar.

However, deaf children have normal and intact language learning abilities. Successful language acquisition for

these children can be expected when they have full access to all aspects of a language (phonology, morphology, and syntax) as well as full access to a natural language such as ASL. To promote this full access of language, deaf children need to have parents who sign, teachers who sign, siblings who sign and friends who sign, and access to an interpreter when there is a situation of a non-signer, such as a doctor appointment. An additional factor that is equally important is that full access to this natural language must occur during the early years of childhood.

Most deaf children, ninety percent, are born to hearing parents who may have exposed their children to spoken English or English based signing. However, even though the child may have been exposed to English from infancy, they rarely, if ever, achieve native fluency in English. These children do acquire a native fluency in ASL because it is the first language that is totally accessible to them, even though it is acquired late (Andrews, Ferguson, Roberts, and Hodges, 1997). Research has not addressed this remaining question: Why do most deaf learners max out at a third-fourth grade reading level if they are innately capable of learning language regardless of a handicap and/or environment?

American Sign Language and English Literacy

ASL is not a manual representation of English with individual signs, it is a complete language, with all the properties of other languages of the world, but it is one that has evolved independently of English.

Phonology of ASL involves four basic parameters: 1) Hand configurations (shape of the hands). 2) Place of articulation (the area on the signer's body where the sign is produced). 3) Orientation of the articulator or the orientation of the hand(s) in relation to the body. 4) Movement, or the motions of the hands from one point to another in signing space (Padden and Ramsey, 1998).

The morphological processes of ASL are organized in a simultaneous rather than sequential fashion. What this means is that ASL morphology operates by nesting the sign stem within dynamic movement contours. These contours occur simultaneously within the sign. For example, for the sign "improve," a single movement would mean improve, while a faster repetitive movement would mean improvement. Syntax in ASL is governed by grammatical facial expressions, spatial syntax, and other nonmanual behaviors (Markowicz and Woodward, 1978).

The use of signing space in ASL plays a large role in signing since it shows grammatical relations among entities by assigning them an arbitrary location within the signing space (Padden, 1996). These locations designate pronouns (he, she) and case relations (he vs. him, or subject vs. object).

The phonology, morphology, syntax, and use of space in ASL demonstrates that it is indeed a natural language with rules for generating grammatically sound phonological, morphological, and syntactical structures (Drasgow 1998 and Radetsky 1994).

Radetsky (1994) explains that earlier research compares the performance of deaf children of deaf parents with deaf children of hearing parents. These comparisons revealed consistent and significant advantages for the children of deaf parents, both in English development and in educational achievement. From these comparisons, it was found that children of deaf parents exhibited better spoken English skills than the children of hearing parents. There have also been academic advantages of deaf children of deaf parents in the development of an internal language base that resulted from their exposure to ASL, which was fully accessible to them during early childhood.

There are two studies that have provided empirical evidence of a positive relationship between ASL and language literacy (Drasgow, 1998). In 1996, Prinz et al, examined the relationship between ASL competence and English literacy (reading and writing). It was found that there was a strong correlation between the two. The second study, Strong and Prinz (1996), validated the relationship between ASL competence and English literacy by determining that the level of ASL proficiency is related to the level of English literacy, and the differences in performance between children of deaf parents and children of hearing parents disappear except at the lowest level of ASL ability when ASL levels are held constant. The conclusion is simply that early exposure to ASL has enduring linguistic advantages, and that increases in ASL fluency are associated with increases in English literacy achievement, regardless of parental hearing status. This would include those hearing parents of deaf children who utilize ASL with their children.

The transfer of language skills from conversational ASL to English literacy should not be assumed or expected because ASL has no written form. Therefore, deaf students do not have existing literacy skills in ASL that can easily

transfer to written English. The transfer from ASL to English is problematic because the respective structures of each language are very different, in both form and modality (Drasgow, 1998). This may explain why a deaf child exhibits difficulty progressing past the 3-4 grade level of language development in reading and writing due to the fact that the two languages are incompatible, especially at the phonological level.

Based on information collected through this literature review, it was found that there is a wealth of information on brain-based learning and brain-based education for regular education students. However, I have found limited to no research conducted on deaf children and the correlation of brain-based learning, with the exception of the sign language studies mentioned.

Many teachers for the deaf confront the language barriers of our students that prevent them from progressing their reading level past a fourth grade level. This limited English proficiency creates difficulties in expressing themselves through language, especially in their reading and grammatical writing skills (Jacobs, 1974).

There is a need to integrate brain-based learning strategies into existing curriculum that is being presented

to the deaf population in our schools. I believe that deaf students can benefit from the research that has been completed on the principles and strategies of brain-based learning and education that may result in increasing the proficiency of the deaf population in the areas of English reading and writing. In chapter four, I will describe a teacher checklist that I have developed for planning a curriculum unit that integrates the principles and strategies of brain-based learning into existing curriculum based on this review of the literature and other collected data.

CHAPTER THREE

METHODOLOGY

The goal and intention of this project is to present a practical and purposeful tool for planning a curriculum unit in science consistent with the needs of deaf students with a low reading level, that would integrate the ideas, principles, and strategies of brain-based learning into existing curriculum used for deaf students. Brain-based principles that I consider essential to good teaching will be outlined as well. Specifically in this project, I will develop a teacher checklist for integrating brain-based principles and strategies into existing curriculum for a deaf education science program.

The following steps will be taken to help insure that the goal of this project is effectively achieved: I will develop the teacher checklist for planning a curriculum unit that integrates the brain-based principles and strategies by reviewing the literature on brain-based principles. A personal journal will be kept during the process of review of the literature that includes ideas of what worked or did not work in my classroom of deaf students, when I experimented with the concepts of brain-based principles and strategies in the review of the

literature, in addition to ideas or relevant information that might assist in the development of the teacher checklist.

The teacher checklist will be developed and field-tested through planning and teaching a unit in environmental science that incorporates the brain-based principles and strategies. During the process of developing the teacher checklist, I will gather data from three sources. First, rubrics will be developed for all group activities during the field-testing; the rubrics will generate data associated with student opinions and ideas. Second, a student questionnaire will be developed that includes questions related to student perception concerning the curriculum unit, primarily whether the integration of brain-based principles and strategies was effective in facilitating their learning. This questionnaire will contain the following information: 1. Did students enjoy the lessons that integrated the brain-based ideas/principles? 2. Did the students demonstrate a better understanding of concepts being presented in their classes that used brain-based ideas/principles? 3. Could students work and complete work independently? 4. Were reading levels increased with the incorporation of brain-

based ideas/principles? 5. In comparison, were anxiety levels regarding test taking prior to the unit and after the unit decreased or increased with the utilization of brain-based ideas/principles? 6. In comparison, was the stress/confusion level on concepts being taught to the students and/or test taking stress/confusion decreased or increased with the utilization of brain-based ideas/principles? 7. Was the students' attitudes toward school and learning in general improved based on classroom learning experiences utilizing brain-based principles and/or strategies? The students will fill out the questionnaire at the end of the curriculum unit.

Last, there will be collaboration with two colleagues, one science teacher and one business education teacher, while I am planning and teaching the unit that will enable me to have the opportunity to "bounce" ideas off of them in order to better meet the needs of my students as to what may or may not work when planning my curriculum unit. These two colleagues will also assist me in evaluating and providing me with feedback on both the teacher checklist and the student questionnaire. The information collected from these collaborations will be recorded in the personal journal.

The teacher checklist and the student questionnaire will then be revised and edited based on any data received from the collaboration with my colleagues, in addition to any data from my personal journal. My colleagues will then evaluate the revised teacher checklist through a questionnaire, as to its effectiveness in integrating the brain-based principles into existing curriculums for deaf students.

In summary, for this project, I will develop a framework for integrating brain-based principles and strategies into an existing environmental education curriculum for my deaf students. This framework will allow me to set up a sample unit for other teachers to review and/or implement in order that they may effectively integrate the brain-based principles and strategies into their existing curriculum for their deaf students.

CHAPTER FOUR

RESULTS

The goal and intention of this project was to present a practical and purposeful tool for planning a curriculum unit in science consistent with the needs of deaf students with a low reading level, that would integrate the ideas, principles, and strategies of brain-based learning into existing curriculum used for deaf students. Brain-based principles that I consider essential to good teaching will be outlined as well. Specifically in this project, I developed a teacher checklist for integrating brain-based principles and strategies into existing curriculum for a deaf education science program.

In this chapter I will first give relevant information about the context of this project and then I will state the results of implementing methodology.

This project was completed at the California School for the Deaf (CSDR) in Riverside, California. CSDR is a residential facility, which simply means that children are able to reside in the dormitory if their home is fifty or more miles from the school. Approximately fifty percent of the students are residential students. All staff in direct contact with students, dormitory and instructional,

are proficient in American Sign Language. The classroom used in this project is in the high school science department and has an adjoining laboratory. The classroom doors open up directly to the outside environment, which allows for access to the outdoors.

The students I chose for this project are in my seventh period environmental education science class. The students consist of nine students, four girls and five boys. Seven of these students are freshman, one is a junior, and one is a senior. The student's reading levels range in level from a Pre-K reading level to 3rd grade reading level, with the majority being Pre-K readers. Books are not effective with these students; I am continually looking for resources that would be more effective with low reading ability deaf students.

Given these characteristics of the school and students, I was interested in finding out if the twelve principles of brain-based learning and various strategies of brain-based learning could be integrated into existing curriculum for the benefit of deaf students that were being taught. After incorporating these twelve principles and strategies into my environmental education curriculum, I was curious to find out if there would be any evidence of

increased student motivation and comprehension, as well as lowered stress/anxiety levels due to traditional test taking anxiety.

Traditional methods of teaching and assessment place unneeded stress on both the teachers and the students in our classrooms. There are increasing demands in our school due to standards based instruction, passing the High School Exit Exam to get a diploma, and the traditional modes of instruction and assessment that creates a barrier to genuine and meaningful learning experiences to occur. Added to those things, we tend to have students who are not concerned about their grades, are susceptible to gang influences, and believe in "the moment" that they will live for the day rather than look ahead and plan for their futures. This attitude leads to self-destruction and needs to be changed before it is too late.

The research portion of this project targeted topic related literature, which included a variety of literary journals, articles, and books, as well as Internet sites/resources on brain based learning. The synthesis of this research resulted in the culmination of the final project: A Teacher Checklist For Integrating Brain-Based

Principles And Strategies Into Existing Deaf Education Curriculum (see Appendix A).

The literature and the journal portions of this project were reviewed on the twelve brain-based principles in addition to the various strategies that other teachers and/or authors have used in the past that connect to the brain-based principles. Based on this review of the literature and the personal journal, I was able to compile the checklist shown in Appendix A. In summary, I listed each of the twelve principles of brain-based learning with a few suggestions on how to integrate the principles of brain-based learning into an existing curriculum. If the existing curriculum does not follow a principle or strategy of the checklist, ideas are given to assist the teacher in altering the curriculum to become a brain-based curriculum. In the next section, I describe the development of the unit, including how the checklist affected the contents of the unit.

From this teacher checklist, I was able to develop and field-test a curriculum unit in environmental education (see Appendix B) using the teacher checklist for integrating the twelve brain-based principles and

strategies into the Project WET curriculum that I use with my deaf students.

We do not have an established environmental education program here at the California School for the Deaf, and I wanted to do a curriculum unit that didn't require me to "make up" all of the curriculum materials and assessments. In addition, a curriculum unit was needed that was flexible enough to allow for the integration of the brain-based principles and strategies. The project WET curriculum met these needs. Project WET is a curriculum that fosters awareness, concern, and interdependence of economic, social, political and ecological issues in urban and rural areas. In addition, Project WET provides opportunities to acquire knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment. I did have to make some changes to worksheets/lab papers that were very wordy in order that my students could utilize them independently or as a group without becoming frustrated. The majority of the lessons were experiential with hands on activities that would not frustrate my low readers. Rather than following step-by-step directions in the lessons provided, the students and I picked and chose activities that would be most effective in addressing the

concept to be taught. This dramatically reduced the stress and anxiety level in the classroom and encouraged meaningful learning, a critical aspect when integrating the brain-based principles into the classroom. Assessments were done as a group or partner presentations, pamphlets, posters, and so on, which also cut back on the anxiety and stress levels of both the learners and the teacher. I really enjoyed using the Project WET curriculum unit activities, since most of the activities were hands on and did not require much reading. Therefore, the students were able to "handle" the tasks that were presented to them during each lesson.

My hypothesis prior to beginning this project was that by enriching the classroom environment with several brain-based principles and strategies I would encourage and accelerate student learning. Prior to beginning this project, it was realized that, as a teacher, I would need to "let go" of the comfort of "living out of" the teacher edition textbooks with their ready-made lesson plans, worksheets, questions, multiple choice tests, and other materials that were set up by a textbook company. The teacher would now serve only as a facilitator and a guide. It was as if we were starting anew since the classroom was

being changed into a learner centered and learner based classroom. With that in mind, I developed an environmental education unit in which the students were encouraged to participate. The students determined how the unit would be organized. The students choose the environmental theme of water. The students also assisted in setting up their own rubrics (expectations) for their projects, assessments, and lab activities. The California Standards of Ecology were followed and integrated into the plans that were made by the students. The students were also encouraged to assist in developing a framework that would integrate various other disciplines: art, music, technology, social studies, history, literature, math, and so on. The curriculum outline in appendix B depicts how both the teacher and the students set up the unit. Brain based learning involves students at the many levels of planning. When they are given the opportunity to make responsible decisions, they become more involved personally which then makes learning meaningful. One of the guiding principles of brain-based learning is that the search for meaning is an innate and basic function of the brain.

Brain based teachers also understand that information becomes meaningful as patterns are found and connections

are made to prior knowledge. When subjects such as literature, history, art, social studies, science, and math are integrated, this provides the opportunity for deeper understanding and allows connections to be made throughout all the disciplines, creating patterns for learning.

The self-organization process was quite difficult in the beginning with the students needing time to adapt to this different method of learning. In the beginning I would allow the students to get into their own groups and to become self organized. I was surprised that most of the time the students would vary their groups for different projects. This allowed the students the opportunity to see with whom they work best.

When I was searching for different strategies to use with my students, I found a variety of strategies that can be integrated into an existing curriculum that encourages brain-based learning. These strategies were compiled from literature review resources in addition to my personal journal and from in-services and classes that I have taken in the past. These strategies were integrated into the curriculum framework developed by the students; they are as follows:

- Apprenticeships. A long-term approach to tutoring a student in a specific subject or content area to encourage deeper, meaningful learning.
- Debates. Debates can be held in class to make the best case, pro/con, for an issue to promote comprehension of a topic
- Drawing. Students can do artistic drawings of concepts being learned in class to depict what it means to them.
- Games. Using a known game and re-designing it to fit the concepts being taught.
- Journals. Writing in a journal provides reflective time as well as concrete evidence of concepts being learned.
- Mind mapping. The use of graphic organizers for understanding relationships, themes, ideas of the concept being taught.
- Model making. Often used as a way to explain a scientific concept. Students are encouraged to build a model of the concept being taught with materials available in the classroom.

- Montage/collages. Use of art to assemble learner thoughts in the form of a collage or montage.
- Multi-status. This assists students in changing status roles: get/give tutoring from/to other students, pairing/coaching/or listening to another student from a different grade level.
- Music. Music can be integrated into any environment, whether it is background classical music to encourage a relaxed state for learning or as a concept set to music to encourage memory of a specific concept.
- Myths. Myths have the ability to bring knowledge to life and take it to higher levels of learning.
- Open discussion. In a threat-free environment, learners have the opportunity to say risky things or have unpopular opinions. Discussions encourage understanding of each learner's differences.
- Peer presenting. Students are given the opportunity to teach their peers.
- Performance. Some concepts can be dramatized to promote better understanding.

- Personal quests. This encourages exploration of a learner's own life, which may encourage the acquisition of family history, hobbies, or personal growth.
- Presentations. Provides learners the opportunity to present their findings on a concept in a low-risk environment with their peers.
- Physical activities. Getting outside and getting physical can promote an "aha" experience which cannot be easily demonstrated in a classroom.
- Reflection. Concepts can be reflected upon, recorded in a journal, and revisited to encourage learning.
- Sculpture. Concepts can be built as a form of sculpture to represent what was learned.
- Spiral learning. Often called layered learning, this type of learning re-visits the same concept four or five times.
- Storytelling. Concepts can often be intertwined into a story, rewritten, and retold by a learner
- Thematic learning. The more disciplines and angles used, the more thorough the understanding.

Several of the above strategies were tried in my classroom to encourage higher level thinking skills and to increase motivation. I wanted to evaluate how effectively the students were able to complete tasks when given various brain-based assignments and with the use of a variety of strategies. The first strategy that was tried was group collaboration. Initially, the class itself was a group in which ordered sharing was practiced to allow students to become comfortable with the group process. We began our group meetings by moving the desks and making a circle in the center of the floor where we would all set down. On a few instances, weather permitting; we would go right outside my classroom and have our group activities under a big tree. In the beginning, the teacher was the facilitator, modeling the way that the group should progress. As the students became more comfortable in the ordered sharing groups, we moved into smaller groups of 3 students each. The teacher stepped out of the groups and acted more as a "coach" going from group to group assisting with any problems that were happening. The groups would be given a task, sometimes all the groups had the same task, other times I would assign different tasks to different groups so that when we would come together as a class

group, the students were better equipped to participate. Within each group, each student had a role: record keeper, timekeeper, or as the group leader (facilitator). The group process worked very well with my deaf students and gave each student the opportunity at the different rates in the group. They understood that the purpose for the small groups was for solving problems and answering questions presented to them through communication and experience. It was stressed that the environment in which each group operated would be psychologically safe, in order that each student would be more willing to volunteer. It was also stressed that each student was a critical element in the group process and what he or she had to say is important. The groups would be presented with an open ended, probing question related to the material being taught. Most of the time, after group collaborations, the question was posted on the board with the different group responses to it. This proved to be very beneficial for encouraging deeper understanding and respect for the other groups' answers. As a facilitator, it was important for me to model the types of responses I expected from the groups. One finding that was of interest is that the group process encouraged curiosity and learning from emotion. Some of the topics

that were presented in the groups for discussion and as a project were touchy topics such as how water is recycled, pollution and its effects on people and habitats, and how Indians and Farmers fight for water rights to their lands. Emotion is a very important aspect to brain-based learning, especially if there is a memory of a specific experience in their life that relates to that emotion.

Every day would include some type of journaling for students, either in class or assigned as homework. Brain-based learning stresses the importance of reflection to encourage a deeper understanding. Each student had his/her own journal. I would not read this journal unless the student turned it in to me. In the beginning, I noticed that most students did not want to share what was in their journal, perhaps due to a trust issue. However; as time passed, students began asking me to read what they wrote whether it be poetry, drawings, or just a letter to me, to a parent, or to a friend that would stay in their journal. I gave students paper clips to attach to their journals to show where they ended their writing. The purpose for the paper clip was to allow the students their privacy while at the same time allowing me to go into their journal to jot down ideas or comments when I noticed a student doing

something good or not so good, or if they participated well in their groups. This feedback would be a source of constructive criticism on how to better them or to "pat them on the back." Almost always, if I wrote in their journals, they would write back to me and give me feedback as to how they felt about a particular class/lab session. As a teacher, I really enjoyed this because it was such an inspiring and caring way to encourage student and teacher learning. Brain-based learning stresses the importance of trust and feedback between learners and their facilitators.

Guided imagery was something I always wanted to try with my students and was very skeptical on how it would work with the deaf learner. Because the deaf student relies on their vision, I could not ask them to close their eyes and "imagine." What I did do was prior to our walk to and from the aqueduct to collect water samples, I asked students to place their hands in their pockets, to prevent them from "talking" and signing to one another, and walk silently reflecting on nature and what smells, sights, and colors they observed for the duration of the walk which was about 10 minutes. Upon returning to the classroom, or if they chose to bring their journal with them on the walk,

they would journal for about 10-15 minutes about their experience.

Outdoor observation and experimentation was easy to integrate into the environmental education lessons that we were working on. Most of the activities required some time outside of the classroom. This was the favorite time for my students. The weather was cooperative for the majority of the time. What really touched me were the spiritual connections that the students had discussed in their groups and to me one on one. Brain-based learning advocates time for reflection, which includes spiritual inspirations. As a group, the students decided they wanted to take a trip to the ocean, so they set up a project specifying what they were going to do: collect salt water samples, measure the amount of salinity and turbidity in the water samples and journal their findings. What they did not expect or plan for was to have a spiritual connection to nature. Out of the nine students who went to the beach, eight of them commented to me on how they see how nature comes together and how the actions of man, such as pollution, over fishing, and other environmental concerns can disrupt an entire ecosystem. This illustrated to me that the students were grasping the concept of holistic interconnected

relationships, another vital component of brain-based learning.

In reflecting on my general philosophy of how students, specifically deaf students, should be taught, I drew up a few questions that I wanted to answer as to the effectiveness of integrating the brain-based principles and strategies into my curriculum unit. In the following paragraphs, I will discuss how theses questions were addressed in the unit, they are as follows: First, can the use of technology be integrated into this unit? Most of this unit integrated technology. Students utilized the Internet to conduct searches on various water topics and content, which was covered during the course of the unit. I used an LCD projector along with power point presentations from my computer station for note taking and demonstrations. Students used Microsoft word spreadsheets and templates for graphing data gathered as well as for typing individual and group presentations. Second, are there alternative ways to communicate (through art, dance, aesthetics, or drama) in this unit? Throughout this unit, I integrated several disciplines into the unit that was being taught. The disciplines that were integrated on a regular basis include language arts (reading, writing,

journaling) as well as math, social studies, some history, and some cultural studies (Indians view of the land/water). Third, are the senses integrated? Due to the fact that the students I teach are deaf, I utilized as much of the senses that I could to enhance their learning. The students themselves preferred to do "artsy" kinds of things, especially when planning their presentations as well as in their portfolios and journals. Many students used role-playing dramatics to help the other students understand the concept/s being taught. In some of the lessons, I would assign a task to each group. This task was to teach a specific word or concept to the rest of the class after discussion of the lesson. This proved to be very effective and gave me, as a teacher a new look at how I could better explain (via sign) concepts being presented. American Sign Language (ASL) is a very visual language and was helpful in explaining concepts using visual imagery. There were a few lessons that contained some difficult to read and understand vocabulary for the students, due to their difficulty in retaining the definition of challenging vocabulary words. The students decided to make a bulletin board as a whole group. This bulletin board depicted the

various talents of each individual student blending into a complete project; it was wonderful to see this.

Fourth, does the plan for instruction address the needs of all students? The needs of the students were addressed as well as addressing the various learning styles of each student. I tried very hard to incorporate different strategies each day in order that I would reach and accommodate the majority, if not all the students. In order to make sure that I was teaching to both hemispheres of the brain, I used right brain strategies such as using imagery, visualized note taking, concept mapping, etc., as well as left brain activities such as discussing concepts logically and intuitively. It is imperative to brain based learning to utilize both hemispheres when you engage students in learning. Fifth, is there an experience I can structure that will deepen their understanding of the unit? Students learn best from experience. In environmental science, most of the lessons provide opportunities that incorporate hands on experiential learning. Going out into the "field," a major part of environmental education provided the students with many opportunities to do various activities which involved getting out of the classroom. Some lessons provided time for simple observational skills

in the outdoors. The students collected water from different parts of the California Aqueduct and brought them back into the laboratory for analysis of pH, sedimentation, salinity, density, etc. Students were able to experience first hand what was in the water samples through these chemical experiments in the laboratory. While walking to the site for water collection, I had the students walk to the site with their hands in their pockets (to prevent the urge to talk/sign to one another) and observe the natural surroundings. Many of the students really enjoyed this activity and wrote down their experiences in their journal. One student wrote about how fresh the air was, another wrote about the clouds, how he had never really noticed them before, another wrote about the flowers they saw which initiated a talk on poisonous plants. This is something I then incorporated on several of our "walks" to collect water or on our observation walks. Students were also able to view and visualize what happens to water when it leaves their homes, where it goes and how water is treated/recycled for consumption by visiting a water sewage treatment plant. Sixth, does this unit provide for student self-evaluation? There are several lessons that provide for student self-evaluation. I also encourage

students to "assess" their own learning by writing in their science journals. If the students had any questions or concerns that may not have been addressed in class, they were often written in their journals. I would then either give them the answer by writing back in the journal, or, if it was a question that I felt the entire class could benefit from, I would present it to the class and we would have a group discussion in which we would come up with the answer as a group with teacher guidance. This way, the teacher can also see how the students self-evaluate themselves and provide feedback on how better to self evaluate if there seems to be discrepancies. Seventh, will this unit be stimulating for the students? When I planned this unit, I wanted a unit that would be based on the five senses and is stimulating for my low achieving deaf students. Normally, classes are held indoors with a visit to the laboratory next door once or twice a week. However, this year our lab is under construction and we were unable to utilize the lab during this unit. With the unit being on environmental education, I was able to take my students out doors into the environment for most of my lessons, which was well received by them because it was something different than what was normally happening in their

classes. In addition, the fieldtrips that we took enabled the students to get out into the community to witness the importance of being involved in a community working to "clean up" our water resources.

I received several comments from the students saying that they really looked forward to my class because we never took notes and never took tests!! Little did they know that their journaling was the "new way of taking notes," their lab experiences were their lessons, and their group presentations, role plays, bulletin boards, internet research, posters, etc were their "tests." This encouraged me and gave me more motivation to continue this unit with my students. In fact, I extended this unit from six weeks to last until the end of the year, another six weeks. Eighth, how can the students and teacher be held accountable in this unit? As with any type of unit in which learning takes place, there needs to be teacher accountability in finding out if the students are grasping the concepts being taught. This is done initially as an entry-level assessment in which student's skills are measured prior to the actual teaching of the unit to see where the student is at in his/her learning. During the course of the unit, periodic assessments are given in the

form of role-plays, experiential learning observation, performance, participation, group involvement in a presentation and so on with a set of rubrics designed for that particular lesson. After the unit a summative assessment was given to assess student knowledge/comprehension of the content presented in the unit.

Students are held accountable through the development of rubrics set up by themselves with the assistance of the teachers in order that they understand and know exactly what is expected in their cooperation groups or for their presentations. These rubrics will also depict the "grade" they will receive given a specific criteria checklist that is used by both the teacher and their peers (during presentations). In addition, there are diverse assessment strategies that relate to the objectives of the activity. Extensions for each activity are provided which could be another alternative form of assessment as well.

Ninth, will students have a blend of work formats? Individual, partner, small group, and whole group? This unit on environmental education involved various work formats with the students. This unit stressed the importance of varied work formats in order that all

learning levels and styles of the students would be addressed. I also incorporated work formats to include left and right brain activities suggested in "How the Brain Learns" by Dr. David Sousa 1995). I assigned various individual assignments, most involving writing in their science journal. I assigned partner groups when we performed chemical and sediment analysis on the water. Small groups were assigned when we went out in the field to collect water samples, take pictures, and do presentations. Whole group formats were used in discussion, questioning, and brainstorming content webs in relation to the unit.

The curriculum unit that was completed that integrated brain-based principles and strategies included lessons that were inquiry-based experiments that encouraged curiosity. This brain-based learning experience allowed the students to witness and become involved participants in what they were learning, rather than listening to "lectures" on the concepts. The lessons were also very good, since most of the materials you needed to complete the lesson are readily available in most classrooms.

Prior to starting the unit, I set up my classroom with several posters that depicted water, the California watershed, water pollution, and the water treatment

process. I utilized many sources of visuals in creating an effective brain-based learning environment for my students. These materials assisted me when I would bring up the specific topics on the poster, whether it is pollution, where our water comes from, how water is recycled, or the water cycle itself.

Particularly helpful with my deaf students was the integration of technology in the classroom. When we searched the Internet as a group, I was able to utilize my computer and the LCD projector, which gave all of the students an idea of how to use search engines, and the www for research purposes to find answers to questions that may be unknown to them. The overhead projector was utilized for any handouts that I had given to the students as well as for the rubrics. This was helpful to both the students and myself. The deaf students catch on faster when visuals (their handouts/rubrics) are presented and explained as a whole group activity.

During the course of this unit, I would make it a point to get out of the classroom and into the environment. This encouraged the brain-based principle of interconnectedness and the search for meaning through patterning. The students really enjoyed getting out of the

classroom, they especially enjoyed several fieldtrips that were taken to the following sites: Riverside Municipal Water District, Water Sewage treatment plant, and walking fieldtrips to the California Aqueduct behind our school in several different spots.

Throughout the unit, we took water samples from various sources, including faucets, rainwater, spring water, mountain water, and so on to analyze. We are fortunate that the California aqueduct runs right behind our school so we were able to venture out for "nature walks" to take samples of the water in the aqueduct at various points. We also went out again after the big rains to see if there was a difference of chemical composition in the water (acid rain). The students were able to comprehend the topic of acid rain even though they couldn't see it; it was measurable when we used Ph strips in the classroom to see the difference. There were times in the lesson when I had to do a lot of explanations, especially when I introduced new vocabulary words, this took a little longer than I had planned. The students needed a lot of assistance in retaining the vocabulary so I ended up integrating additional homework assignments that utilized the vocabulary words. We struggled with this at first, and

I realized that they might do better by making a classroom bulletin board with the vocabulary words so that they could utilize/see them on a daily basis. The students worked well together in creating this bulletin board by using a combination of pictures and words to depict each difficult word. As the unit continued, I would have the students add the words that were difficult for them to comprehend. This ended up being an unexpected and unplanned project that the students completed as part of their final assessment.

When searching the Internet as a group, the students found many good websites. Pearson learning offers exploration of the brain at their website, www.pearsonlearning.com; a website that offers brain expansion games as well as a virtual and real museum of science, art, and human perception for students of all ages can be found at www.exploratorium.org; www.jlcbrain.com/truth.html gives information on the truths and deception of brain based learning; New Horizons, a nonprofit organization in Washington state, www.newhorizon.org/blab.html, offers a brain lab where students can study the parts of the brain and its functions; www.funderstanding.com/truth.html is another website for activities on brain-based learning. A good

website for teachers is www.brains.org, this website offers practical classroom application of current brain-based learning research.

I was unable to complete all of the lessons that were planned due to many unforeseen circumstances that came up: eleven days of sat-6 and STAR testing, IEP meetings, assemblies, and so on.

I will summarize the results of the two methods of gathering data: the teacher questionnaire and the student questionnaire. The teacher questionnaire was developed to ensure that the teacher checklist for integrating brain-based principles and strategies into existing curriculum units was an effective tool. Table one details the answers given by the two evaluators of the teacher checklist, the questions are taken from the questionnaire found in Appendix D. The answers are a summary from the questionnaires that each evaluator was asked to complete and can be found in Appendix F.

Table 1. Teacher Questionnaire Results

QUESTIONS ON TEACHER CHECKLIST	Evaluator 1	Evaluator 2
1. The information from the	1	1

checklist is understandable.		
2. The information from the checklist is practical. I can see implementing these ideas into my existing curriculum. TEACHER COMMENT: EVALUATOR 1: "Many good teachers already do these things in their classrooms, however, it was helpful to be able to check off these areas when planning a unit."	1	1
3. The information from the unit outline is understandable	1	1
4. The information from the unit outline is practical. I can see implementing these ideas into my existing curriculum.	1	1
5. The questions on the questionnaire are at the student's level.	1	1
6. The questions on the questionnaire are understandable.	2	1
7. The questions, in your opinion would yield valid results on the student's reaction toward brain-based learning.	2	1
8. The combined documents provide me with new information about how learning occurs and offers effective brain-based learning strategies.	1	1
9. The combined documents promote creativity in teaching and in learning.	1	1
10. The combined documents provide the means for an interconnected and interdisciplinary brain-based curriculum.	1	1

In summary, table one indicates to me that questions one through five and questions eight through 10 yielded significant results that conclude that the teacher checklist for integrating brain-based principles and strategies into existing curriculum would be a successful tool in assisting a teacher. Evaluator one's comment on question number two, "Many good teachers already do these things in their classrooms, however, it was helpful to be able to check off these areas when planning a unit," indicates to me that the checklist is highly effective when evaluating how to integrate the brain-based principles into existing curriculum.

Table two consists of responses of both evaluators of the teacher checklist.

Table 2. Additional Information Responses

Additional information questions	Evaluator 1 Response	Evaluator 2 Response
11. The most helpful part of the combined documents is _____ because_____	"This checklist has afforded me many idea's on how I can use Cynthia's ideas into my business education class."	"The teacher checklist assisted me in planning a brain based unit."
12. If I could add, or delete	"The in-service that you did with	"I would not change

to any part of the checklist, curriculum unit, or student questionnaire, I would add _____ because_____	us, helped clarify what was on the checklist."	anything, you did a good work."

The two teachers, who evaluated the checklist, commented on how they enjoyed my presentation on how to integrate brain-based principles and strategies into existing curriculum. As stated by one of the evaluators: "This checklist has afforded me many ideas on how I can use some of Cynthia's ideas into my business education class and the in-service that you did helped clarify what was stated on the checklist." Another evaluator stated: "I feel that many good teachers already do these things in their classrooms; however, it was helpful to be able to check off these areas when planning a unit, especially now with all of the standards we are required to integrate as well." Consequently, there were minimal revisions made on the student questionnaire as well as the teacher checklist, mainly spelling and grammatical errors.

Below is a table that compiles information from the student questionnaires numbers one through twelve, and numbers one through eight. The questions are stated and

the number shows how many students chose the following: one = strongly agree, two = agree, three = disagree, and four = strongly disagree. This questionnaire can be found in Appendix E.

Table 3. Student Questionnaire Results

Question from student questionnaire	1 strongly agree	2 agree	3 dis-agree	4 strongly disagree
1. I enjoyed the unit lessons being taught.	6	2	1	
2. The assignments & projects were easy to understand.	5	3	1	
3. This unit was very stressful in terms of assignments/projects.			1	8
4. This unit was very stressful in terms of test taking/assessments?			2	7
5. It was easier to understand the concepts being taught in this unit compared to earlier units.	6	3		
6. The cooperative collaborative group that you were in was effective in helping you understand the concepts being addressed?	5	4		
7. You had less anxiety during this unit in comparison to previous units.	8	1		

8. You had some confusion as to what your role was in the learning process.		5	3	1
9. You were given clear expectations (rubrics) for your assignments and assessments.	9			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.	5	3	1	
11. I feel I benefited greatly from this type of learning process.	9			
12. I would like to see other subject units set up in the same manner as this environmental education unit.	8	1		
1. Adequate and natural lighting.	5	3	1	
2. Comfortable room temperature.	4	5		
3. Your class work is displayed in the classroom.	3	5		
4. Learning opportunities are challenging.	4	4		
5. Individual differences being respected and valued.	8	1		
6. Decreased stress level in class (elimination of pop quizzes, competitive grading).	9			
7. Variety of technology resources	8	1		

(computer, internet, LCD projectors, smart board, net television, etc.).				
8. Being able to participate in planning criteria and scheduling projects and assessments	7	1		

As depicted in table three, the majority of the students strongly disagreed to the question "this unit was very stressful in terms of assignments/projects" as well as the question "this unit was very stressful in terms of test taking/assignments." This is significant, since the major barrier to learning is a stressful situation which can cause downshifting. These results clearly show that downshifting would not occur when the brain-based curriculum is being used. Another significant finding is that most students strongly agreed with these statements: question seven "you had less anxiety during this unit in comparison to previous units," question nine "you were given clear expectations (rubrics) for your assignments and assessments," question eleven "I feel I benefited greatly from this type of learning process," question twelve "I would like to see other subject units set up in the same manner as this environmental education unit," in the second

part of the questionnaire; question five "individual differences being respected and valued," question six "Decreased stress level in class (elimination of pop quizzes, competitive grading)", question seven "Variety of technology resources (computer, internet, LCD projectors, smart board, net television, etc.)", and question eight "Being able to participate in planning criteria and scheduling projects and assessments."

Table four is the results of activities that were most enjoyable to the students during the unit being presented.

Table 4. Student Activity Preferences Results

Journaling	8
Portfolios (learning logs)	4
Guided imagery	6
Collaborative groups	8
Planning unit	8
Creating bulletin boards	7
Completing power point presentations as a partnership	5
Group internet searches	7
Integration of Art into unit	6
Group and partner laboratory experiences	8
Outdoor classroom (going outside to observe, collect samples, and experiment).	9

As table four shows, the majority of the students preferences were the following strategies: journaling, collaborative groups, assisting and participating in planning the curriculum unit, creating bulletin boards, conducting group internet searches, group and partner laboratory experiences, and outdoor classroom education (getting out of the classroom to observe, collect data, and experiment).

The student questionnaire is supported and validated by the brain-based rationale. This validation was extended though the students' input and comments upon completion of the curriculum unit. The nine students who participated in this curriculum unit were asked to fill out a questionnaire. The questionnaire was signed to the students as a group due to their limited English proficiency to ensure that each question asked was understood and would yield a valid result. Students responded with comments such as "I love not having to take tests," "I don't usually have fun in class cuz it is too serious and I felt like I learned more in this class than I have in other boring classes." The conclusions and implications of these results will be discussed in Chapter five.

CHAPTER FIVE

CONCLUSIONS AND IMPLICATIONS

This chapter will discuss the conclusions taken from the evaluations for the final project and will address the implications of the entire research project in regards to the profession of teaching the deaf.

The final project consisting of a teacher checklist for integrating brain based learning principles and strategies and the sample proposed brain-based curriculum unit is intended to promote the analysis of instructional practices in a classroom for deaf children, inspire creativity, encourage ingenuity, and stress the importance of motivation in learning. This project provides a practical approach to integrating the brain based principles and strategies into existing curriculum for the deaf.

The teacher checklist is supported and validated by the brain-based principles. This validation is extended into the curriculum unit outline, which offers ideas on integrating some brain based strategies as well as ideas on how to integrate the disciplines such as math, history, social studies, art, and other subjects.

The principle implication of this project is to encourage educators to shift their teaching styles from the linear traditional ways to the multi-directional, diversified, and integrated ways of brain-based learning. This project encourages teachers to shift the learning environment from being teacher centered to being differentiated, constructivist, and student centered learning environments.

As the data from chapter four depicts, the majority of the students enjoyed the curriculum unit that was based on the twelve brain-based principles of learning. The data shows that the students understood the assignments and had clear expectations on those assignments. They felt that the cooperative group was an effective instrument in their learning, despite the fact that there was a bit of confusion as to their individual roles in those cooperative learning groups. In my opinion, the most significant piece of information is that the data clearly shows is that there was very little stress for students, if any, in addition to less anxiety in relation to learning and test taking. The students' data stressed that most agreed that they should be included in all planning stages of their learning in addition to the importance of displaying their work.

Students provided positive feedback to me regarding their enjoyment of the "stress free" environment during this project, mostly the result of formal traditional testing techniques being "thrown out." Data also depicts that the students desire and welcome challenging opportunities, respect of their differences, and the integration of technology. All of the data collected clearly provides information in relation to better student performance, lower stress levels, and a non-threatening environment; all powerful components of a brain-based learning environment.

While teaching this brain-based integrated curriculum unit, I realized that what is most enjoyable about environmental education is that it provides teachers with ideas on "action projects" which can be used to stimulate the students involvement in the community while at the same time working on resolving, helping or fixing a current environmental problem in their community; a very powerful strategy of brain-based learning. However, in this unit, I was unable to incorporate an "action project" due to time and planning limitations.

What I would do differently next time is to do an ongoing lesson on charting samples from the entire California Aqueduct from our school all the way to the

beach. This would be a fieldtrip that would last the entire day, once during the fall, once in the spring, and once in the winter to observe any measurable changes in relation to seasons. This would then provide the opportunity for students to see the differences of water samples collected close to our school as opposed to the samples collected near the beach (pH, salinity, sedimentation, etc.) in addition to a long-term study. I would also set up groups in order that the students better understand their roles in the group, perhaps by using students from this project to model the group dynamics for the current students.

Because our new laboratory was being remodeled, I was concerned that I would not be able to complete many of the laboratory experiences that the Project WET recommended and what the California standards required. What was nice about the Project WET activities and lab experiments, is that most of them could be conducted in the classroom or "at the site" with little or no problem/changes. Next year when our lab is up and running I would like to utilize the lab to its fullest by conducting more thorough research in the lab involving the water samples.

One thing that would be done differently is that more time would be allotted for introduction of the concepts of environmental education and its holistic nature. I would have taken more time with my students to introduce the subject rather than "diving straight in" with activities.

These findings have important implications for teachers of the deaf in developing thinking and learning skills for our deaf students. A teacher's job is to orchestrate learning so that many aspects of learning are engaged as possible.

APPENDIX A:

TEACHER CHECKLSIT FOR INTEGRATING BRAIN-BASED PRINCIPLES AND STRATEGIES INTO EXISTING CURRICULUM

TEACHER CHECKLIST FOR PLANNING A BRAIN-BASED INTERDISCIPLINARY UNIT

When planning an integrated curriculum unit that integrates the brain-based principles in addition to other interdisciplinary subjects to any type of students at any grade level, always remember the three important factors of an effective learner centered environment: Relaxed alertness, orchestrated immersion into complex experiences, and active processing. These factors are explained in detail under the heading "results."

Principle one: The brain is a living system.

- ☐ Look at each student not as a machine that we pour information into, but rather as a complex whole being who benefits from the entire learning experience, not just what we tell him or her.

Principle two: The brain/mind is social.

- ☐ Is the unit taking into account the social relationships and human interaction that have an impact on learning?

Principle three: The search for meaning is innate.

- Is the unit designed to allow for personal and meaningful processing of an experience or experiences?
- Is the learner actively processing, consolidating, and internalizing the information in a personal, meaningful, and conceptually coherent manner?
- Does the experience immerse the learner in multiple, complex interactive experiences (orchestrated immersion)?

Principle four: The search for meaning occurs through patterning.

- Does the unit fit together naturally?
- Are concepts rather than facts being addressed? The core patterns of how life works depends on organizing ideas/concepts rather than memorization of facts.
- Does the unit take into consideration that new ideas are the new patterns that learners need to understand?
- Does the unit integrate the arts to enable the learner to examine patterns? Patterns that occur

naturally are: hexagons, branches, meanderings, spirals, and explosions. These patterns can be integrated easily into the arts.

Principle five: Emotions are critical to patterning.

□ Does this unit take into consideration the feelings and emotions of the learners? Each learner comes to us with feelings/emotions tied to past experiences. We naturally interpret new experiences in terms of our past experiences.

□ Does this unit build on experiences in order that complex/in depth concepts are learned?

Principle six: Every brain simultaneously perceives and creates parts and wholes.

□ Does this unit integrate the wholes and parts of the concept being taught?

□ Does this unit explore holons? Explore stories and/or projects? There is a natural sense of wholeness and connectedness to these strategies that should be encouraged in brain-based learning.

□Is art and science integrated into this unit? Art and science reinforces the need to teach in a way that allows for the parts and wholes to interact

continuously. This relationship of parts to wholes is crucial to pattern detection.

Principle seven: Learning involves both focused attention and peripheral perception.

- Does this unit take into consideration the fact that learners are continually scanning their context, being attracted by outer events yet being driven by what interests and motivates us?
- As a teacher, do you take into consideration the relationship between you and your students; the relationship you have with other adults; the design of the buildings; the atmosphere of the school and classroom; sensory input such as the use of light, sound, art, and music; the environment being intellectually stimulating; the life environment of your learners and so on?
- Is the learning environment one that is enriched and encourages learning? Is it comfortable, caring, and relaxed?

Principle 8: Learning always involves conscious and unconscious processes.

- As a teacher, have you developed mindfulness? Are you aware of your learners' needs and of what is happening in the classroom? Do you take the time to observe what is going on, and learn from those experiences?
- Does this unit encourage the power of unconscious processing through use of the conscious mind?
- Does this unit encourage all participants to have an "open mind"? This is vital to both learning and teaching.
- Does this unit allow for creative problem solving? Do you as a teacher help learners formulate questions of real and personal interest? Does this unit allow the learners to have and process relevant experiences?

Principle nine: We have at least two ways of organizing memory.

- Does this unit combine rote learning and more complex experiences? Both memory systems are needed; however, teachers need to set the conditions for how effectively learners use the systems. The key is to

be able to embed new information and skills in the context of real and complex experiences. Learners must look for meaning, which requires them to use their locale memory system in conjunction with new information.

Principle ten: Learning is developmental.

□ Does this unit build on foundations?

□ Does this unit enrich the experience for each learner? Is the learning environment complex, stimulating, and safe? Experience changes the physiological structure and operation of the brain.

□ Do the students observe you, the teacher, using critical thinking skills, persevere in tense situations, and demonstrate a love for learning?

□ Does this unit integrate the qualities that we want to develop in our learners?

Principle eleven: Complex learning is enhanced by challenge and inhibited by threat associated with a sense of helplessness or fatigue.

□ Does this unit ignite the learner's intrinsic motivation?

- Does this unit empower the learner? Is the learner given genuine choices and an active role in his or her learning?
- Does this unit allow for authentic assessment of student learning? Testing without the traditional paper/pencil, multiple-choice methods.
- Does this unit allow for feedback between the learner and the teacher?
- Does this unit allow the learner to take risks in a safe environment?

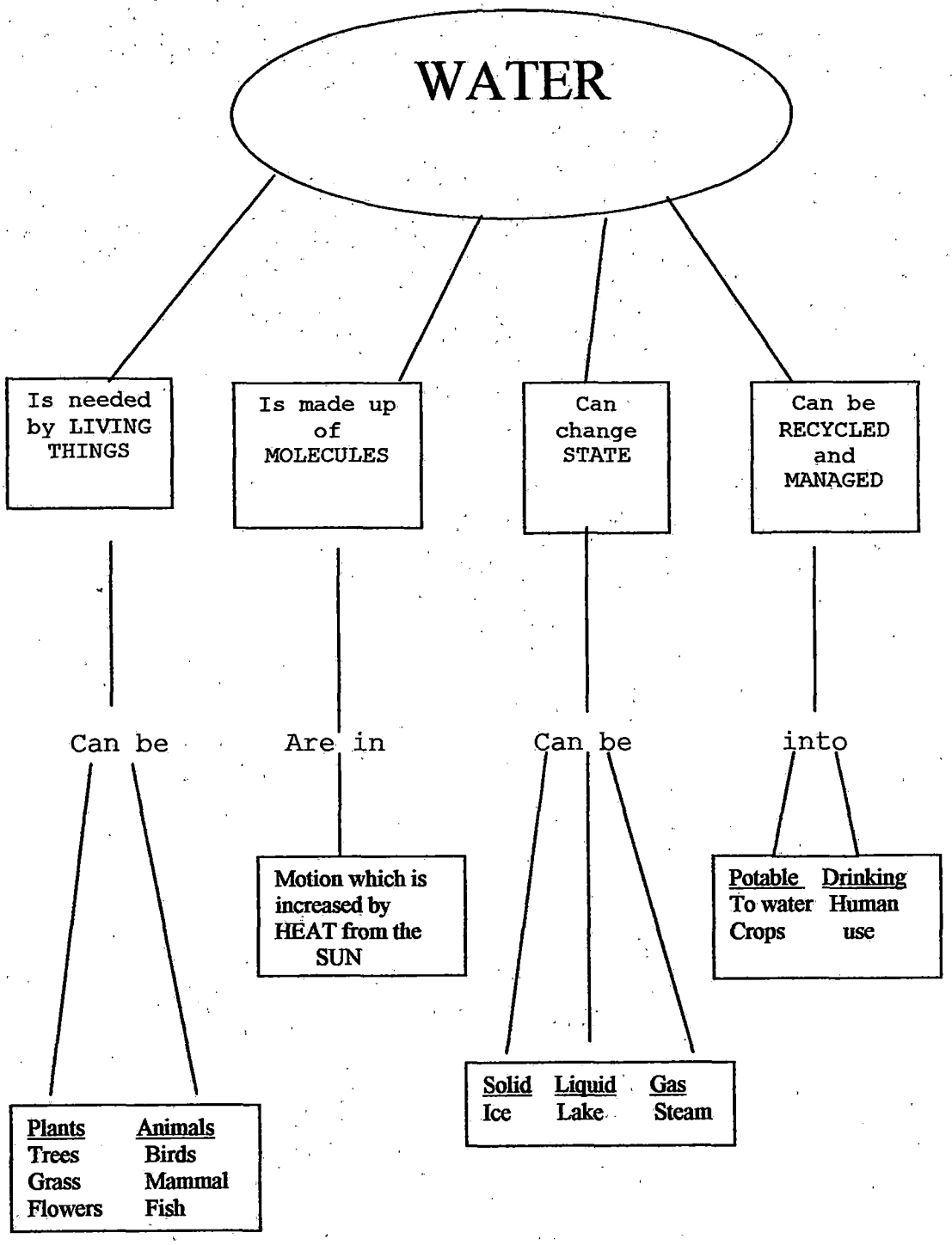
Principle twelve: Every brain is uniquely organized.

- Does this unit take into consideration the differences in all learners by building community among the learners and encourage creativity through complex projects and experiences?
- Does this unit promote the use of journaling to allow participants time to record personal reflections on classroom experiences and other contributing factors?
- Does this unit allow for group collaboration, which takes into consideration the different skills that each individual brings into the group?

APPENDIX B:

BRAIN-BASED CURRICULUM UNIT OUTLINE

OVERVIEW OF CURRICULUM UNIT:



CURRICULUM UNIT SET UP: 6-WEEK UNIT

1) Physical and Chemical Characteristics of Water 1 ½ weeks
   a. Adventures in density (25)
   b. Water Olympics (30)
   c. Hangin' together (35)
   d. Is there water on zork (43)
   e. Molecules in motion (47)
   f. Water match (50)
   g. What's the solution (54)
   h. Feeling the heat make my molecules dance (117)

2) Water is Essential to Life 2 weeks
   a. Aqua bodies (63)
   b. Aqua notes (66)
   c. Lets even things out (72)
   d. The life box (76)
   e. Life in the fast lane (79)
   f. No bellyachers (85)
   g. People of the bog (89)
   h. Poison pump (93)
   i. Salt marsh players (99)
   j. Super sleuths (107)
   k. Thirsty plants (116)
   l. Water address (122)

3) Management 1 1/2 weeks
   a. One in a billion Water (93)
   b. What runs off the school grounds (115)
   c. Who is responsible for water (123)
   d. Delta Dilemma (151)
   e. The Price is right (175)

4) Experiments
   a. Sedimentation rates
   b. PH testing of water samples taken from aquarium, rainwater, faucets, waterway, etc.
   c. Survey a local waterway
   d. Water pollution and water plants
   e. Chlorination: How much is just enough
   f. How to read your water meter (165)

5) Assorted Activities
   a. Earth's sponge (129)
   b. How groundwater moves (133)

c. The aquifer (137)
d. Precipitation (173)

IMPLICATIONS OF INTEGRATING BRAIN-BASED LEARNING INTO ENVIRONMENTAL EDUCATION:

- Activities should promote touching, seeing, feeling, and smelling as ways for gathering information about the environment.
- Activities should offer students of differing cognitive abilities the opportunity to participate and succeed.
- Student's use of art forms and media can provide valuable information concerning their knowledge of and attitudes toward their environment.
- Discussion and guided questioning by the teacher may promote understanding of environmental phenomena as they relate to their experience.
- Activities may deal with several variables and promote the search for logical relationships
- Activities that emphasize predicting will be developed.
- Activities should provide opportunities for making moral decisions on a basis other than what is right or wrong for one as an individual.
- Activities should promote the formulation of hypotheses based on data and the development of means for testing them.
- Activities will be developed around more complex issues to be resolved through group processes.
- Activities should promote choice and decision-making in a context of responsible action.

GOAL OF CURRICULUM UNIT:

- To foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas.
- To provide every student with opportunities to acquire knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment.

- To create new patterns of behavior of individual students, groups of students, and society as a whole towards the environment.

OBJECTIVES OF CURRICULUM UNIT:

- To help students acquire an awareness and sensitivity to the total environment and its problems.
- To help students gain a variety of experience in, and acquire a basic understanding of, the environment and its problems.
- To help student acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
- To help students acquire the skills for identifying and solving environmental problems.
- To provide students with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

OVERVIEW OF UNIT:

I am developing an environmental education program at my school, which I am hoping will be approved and incorporated into a science class to be offered here at CSDR. Below is an outlined version of the program I would like to initiate.

I. Why is it important to have an environmental education program at CSDR?
   a. Environmental education is aimed at producing citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work towards their solution.
   b. Environmental education offers motivating and relevant content, is interdisciplinary in nature, addresses a variety of learning styles which will accommodate all students, utilize cooperative groups in learning concepts, and rely on connectedness between people and nature.

II. Program idea:
   a. Program should be learner focused, based on the known developmental characteristics of learners in grades K-12.
   b. Program should be holistic, considering natural, built, technological, and social environments wherewith encompasses economic, political, cultural, ethical, and aesthetic aspects.
   c. Program needs to be universally oriented, not only for the ecosystem of Earth, but also for the entire universe.
   d. Program needs to be future oriented, demonstrating concern not only for the present inhabitants of Earth, but for future inhabitants as well.
   e. Program needs to be issue oriented, examining issues through all perspectives: local, state, regional, national, international, and universal.
   f. Program needs to be action oriented, directly involving participants in the resolution of problems and issues.
   g. Program needs to be continuous, serving students' in all subject areas at all grade levels.
   h. Program must be interdisciplinary, drawing its content from all disciplines.
   i. Program must be experience oriented, employing a diverse array of learning environments and instructional approaches, utilizing direct experiences whenever possible.
      i. (Engleson, page 6)

III. Rationale for having an environmental education program at CSDR:
   a. Scientists bring our attention to problems such as global warming, ozone layer depletion, deserts consuming agricultural land, endangered species, etc. The only solution to the crisis of environmental problems is sustainable development, development that seeks to meet the needs and aspirations of the present without compromising the ability to meet those needs of the future. This can be met through environmental education of students K-12.
   b. Teachers need to prepare students to become citizens who will be able to effectively

participate in decision-making processes with the leaders of our country. They need to understand how environmental, economic, and social systems function and then realize that environmental, economic, development, and social issues are inseparable, and recognize that opportunities exist in which they can participate.

IV. Overview of goals and objectives of an environmental education program:
   a. The goals of an environmental education program are as follows:
      i. To foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas.
      ii. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect, and improve the environment.
      iii. To create new patterns of behavior of individuals, groups, and society as a whole towards the environment.
   b. The objectives of an environmental education program are as follows:
      i. Awareness- to help social groups and individuals acquire an awareness and sensitivity to the total environment and its problems.
      ii. Knowledge- to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its problems.
      iii. Attitudes- to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
      iv. Skills- to help social groups and individuals acquire the skills for identifying and solving environmental problems.
      v. Participation- to provide social groups and individuals with an opportunity to be actively involved at all levels in working

towards resolution of environmental problems.

V. Brain-based strategies that will be used in teaching environmental education:
   a. Hands on learning experiences through problem solving and project based activities
   b. Team teaching across the disciplines when possible and as much as possible.
   c. Adaptations to be made to individual students and their unique skills and abilities.
   d. Development of knowledge, understanding, and appreciation for the environment, community, and natural surroundings
   e. Pursuit of student questions will be highly valued
   f. Curricular activities rely on primary sources of data and manipulative materials.
   g. Students will be viewed as thinkers with emerging theories about the world.
   h. Teachers behave in an interactive manner, mediating the environment for their students.
   i. Teachers seek the students' point s of view in order to understand students' present conceptions for use in subsequent lessons.
   j. Assessment of student learning is interwoven with teaching and occurs through teacher observations of students at work and through student exhibitions and portfolios.
   k. Student work is primarily in cooperative groups.

VI. Curriculum materials to be used in our environmental education program:
   a. Project WILD
   b. Project Aquatic
   c. Project Learning Tree
   d. Teaching Basic Skills Through Environmental Education Activities
   e. California Environmental Education Guide (ERIC)
   f. Compendium for Integrated Waste Management and Used Oil (CA Department of Education)
   g. Compendium for Water Resources (CA Department of Education)
   h. Conserve Water
   i. Project WET

j. Taking Action (Project WILD supplement)
k. Focus on Risk (Project Learning Tree supplement)
l. WOW! The Wonders of Wetlands
m. The Ways of the Watersheds
n. San Diego: World in Harmony
o. Earth, the Water Planet
p. Always a River
q. Water Wisdom
r. California Class Project
s. Environmental Science Activities Kit
t. Groundwater Study Guide
u. Groundwater Education
v. Every Drop Counts
w. California's Water Problems
x. H20-2010
y. Hands on Environmental Science Activities
z. The Geography of Water

VII. Expected outcomes of having an environmental education program
   a. Citizens/students will be educated and demonstrate responsible environmental behaviors.
   b. Citizens/students will be environmentally literate
   c. Citizens/students will demonstrate environmental sensitivity toward the environment and its problems. They will develop beliefs, values, and attitudes that positively affect the environment.
   d. Citizens/students who will have in depth knowledge of issues the environment faces. Students will identify issues and sources; understand the impact of communities and people's culture, attitudes, and values. They will understand the difficulties that communities have in resolving environmental issues, etc.
   e. Citizens/students will use problem-solving skills when investigating issues.
   f. Citizens/students will develop good citizenship skills in the form of taking action. Students will understand the need for taking action, will be able to identify action categories (political, legal, or eco-management). Students will also be able to examine case studies and as an individual or group take action.

g. Citizens/students will develop an internal locus of control. Thinking that their actions make a difference vs. external locus of control.

APPENDIX C:

GROUP RUBRICS

RUBRICS FOR COOPERATION GROUPS:

Objective: To utilize a cooperative group assessment strategy that is fair to each student while providing motivation for the group to complete the task as a whole.

Technique: The group grade is determined according to a rubric. Consideration is given to at least three parameters such as Content, Representation, and Presentation. The following values are assigned to each of these areas:

	4	3	2	1
Content	Students answered all components of the task clearly	Students answered all components of the task with unclear conclusions	Students did not cover all components	Vague expression of the issue
Represen-tation	Content expressed clearly with a variety of modalities	Content expressed clearly with missing connections between components	Content missing connections	Some content expressed, yet unclear and unresolved
Presen-tation	All students participated in signing and presenting the materials, signing clearly and cooperating in the delivery of the presentation	Most students participated signing and organization was good	Some students did not participate and it was hard to understand part of the presentation	Some disruptions or inappropriate solutions; off task behaviors

Grading Scale: 12=A+, 11=A-, 10=B+, 9=B, 8=B-, 7=C+, 6=C-, 5=D, 4=D-, <3=F

APPENDIX D:

TEACHER EVALUATION QUESTIONNAIRE

Master's Project Evaluation Form

Dear Participating Teacher,

This evaluation form is used to assess the attached master's project, which includes a Teacher Checklist For Integrating Brain-Based Principles and Strategies Into Existing Curriculum, a Brain-Based Curriculum Unit Outline, and Student Questionnaire. Please respond to all questions according to your professional expertise. Your suggestions and comments are important and appreciated.

Thank you for your assistance with this project.

Cynthia Szabados, CSUSB Graduate Student

Directions: Please indicate the extent to which you agree with the following statements. A space is provided for your comments after each statement. Please attach additional paper if needed.

1=Strongly Agree 2=Agree 3=Disagree 4=Strongly Disagree

Regarding the Teacher Checklist only:

1. The information from the checklist is understandable.
1 2 3 4

Comments_____

_____

2. The information from the checklist is practical. I can see implementing these ideas into my existing curriculum.
1 2 3 4

Comments_____

_____

Regarding the Brain-Based Curriculum Unit Sample:

3. The information from the unit outline is understandable.

1 2 3 4

Comments_____

_____

4. The information from the unit outline is practical. I can see implementing these ideas into my existing curriculum.

1 2 3 4

Comments_____

_____

Regarding the Student Questionnaire:

5. The questions on the questionnaire are at the student's level.

1 2 3 4

Comments_____

_____

6. The questions on the questionnaire are understandable.

1 2 3 4

Comments_____

_____

7. The questions, in your opinion would yield valid results on the student's reaction towards brain-based learning.

1 2 3 4

Comments_____

_____

Regarding the Teacher Checklist, Brain-Based Curriculum Unit Outline, and Student Questionnaire as a combined document:

8. The combined documents provide me with new information about how learning occurs and offers effective brain-based learning strategies.

1 2 3 4

Comments_____

_____

9. The combined documents promote creativity in teaching and in learning.

1 2 3 4

Comments_____

_____

10. The combined documents provide the means for an interconnected and interdisciplinary brain-based curriculum.

1 2 3 4

Comments_____

_____

Additional Information:

11. The most helpful part of the combined documents is _____ because

_____

_____

_____

_____

12. If I could add or delete to any part of the checklist, curriculum unit outline, or student questionnaire, I would add _____ because

_____

_____

_____

_____

Thank you for completing and returning this evaluation!

APPENDIX E:

STUDENT QUESTIONNAIRE

STUDENT QUESTIONNAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.				
2. The assignments/projects were easy to understand.				
3. This unit was very stressful in terms of assignments/projects.				
4. This unit was very stressful in terms of test taking/assessments?				
5. It was easier to understand the concepts being taught in this unit compared to earlier units.				
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?				
7. You had less anxiety during this unit in comparison to previous units.				
8. You had some confusion as to what your role was in the learning process.				

9. You were given clear expectations (rubrics) for your assignments and assessments.				
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.				
11. I feel I benefited greatly from this type of learning process.				
12. I would like to see other subject units set up in the same manner as this environmental education unit.				

COMMENTS: _____

_____

_____

_____

Please check which of the following activities you enjoyed most during this unit?

Journaling	
Portfolios (learning logs)	
Guided imagery	
Collaborative groups	
Planning unit	
Creating bulletin boards	
Completing power point presentations as a partnership	
Group internet searches	
Integration of Art into unit	
Group and partner laboratory experiences	
Outdoor classroom (going outside to observe, collect samples, and experiment).	

Please rate the importance of these factors in your opinion which were conducive to your learning:

1= Very important 2= Important 3= Somewhat important 4= Not important

	1	2	3	4
1. Adequate and natural lighting.				
2. Comfortable room temperature.				
3. Your class work is displayed in the classroom.				
4. Learning opportunities are challenging.				
5. Individual differences being respected and valued.				
6. Decreased stress level in class (elimination of pop quizzes, competitive grading).				
7. Variety of technology resources (computer, internet, LCD projectors, smart board, net television, etc.).				
8. Being able to participate in planning criteria and scheduling projects and assessments				

APPENDIX F:

MASTER'S PROJECT EVALUATION FORMS: DATA COLLECTION FROM STUDENTS AND COLLEAGUES

Master's Project Evaluation Form

Dear Participating Teacher,

This evaluation form is used to assess the attached master's project, which includes a Teacher Checklist For Integrating Brain-Based Principles and Strategies Into Existing Curriculum, a Brain-Based Curriculum Unit Outline, and Student Questionaire. Please respond to all questions according to your professional expertise. Your suggestions and comments are important and appreciated.

Thank you for your assistance with this project.

Cynthia Szabados, CSUSB Graduate Student

Directions: Please indicate the extent to which you agree with the following statements. A space is provided for your comments after each statement. Please attach additional paper if needed.

1=Strongly Agree 2=Agree 3=Disagree 4=Strongly Disagree

Regarding the Teacher Checklist only:

1. The information from the checklist is understandable.
(1) 2 3 4

Comments _____

_____

2. The information from the checklist is practical. I can see implementing these ideas into my existing curriculum.
(1) 2 3 4

Comments Many good teachers already do these things in their classrooms! However, it was helpful to be able to check off these areas when planning a unit.

Regarding the Brain-Based Curriculum Unit Sample:

3. The information from the unit outline is understandable.

(1) 2 3 4

Comments _____

_____

4. The information from the unit outline is practical. I can see implementing these ideas into my existing curriculum.

(1) 2 3 4

Comments _____

_____

Regarding the Student Questionaire:

5. The questions on the questionnaire are at the student's level.

(1) 2 3 4

Comments _____

_____

6. The questions on the questionnaire are understandable.

1 (2) 3 4

Comments _____

_____

7. The questions, in your opinion would yield valid results on the student's reaction towards brain-based learning.

1 (2) 3 4

Comments _____

_____

Regarding the Teacher Checklist, Brain-Based Curriculum Unit Outline, and Student Questionaire as a combined document:

8. The combined documents provides me with new information about how learning occurs and offers effective brain-based learning strategies.

(1) 2 3 4

Comments_____

_____

9. The combined documents promotes creativity in teaching and in learning.

(1) 2 3 4

Comments_____

_____

10. The combined documents provides the means for a interconnected and interdisciplinary brain-based curriculum.

(1) 2 3 4

Comments_____

_____

Additional Information:

11. The most helpful part of the combined documents is _____ because

this checklist has afforded me many ideas on how I can use Cynthia's ideas into my business education class.

_____

_____

12. If I could add or delete to any part of the checklist, curriculum unit outline, or student questionnaire, I would add _____ because

The inservice that you did with us helped clarify what was on the checklist.

_____

_____

Thank you for completing and returning this evaluation!

Master's Project Evaluation Form

Dear Participating Teacher,

This evaluation form is used to assess the attached master's project, which includes a Teacher Checklist For Integrating Brain-Based Principles and Strategies Into Existing Curriculum, a Brain-Based Curriculum Unit Outline, and Student Questionaire. Please respond to all questions according to your professional expertise. Your suggestions and comments are important and appreciated.

Thank you for your assistance with this project.

Cynthia Szabados, CSUSB Graduate Student

Directions: Please indicate the extent to which you agree with the following statements. A space is provided for your comments after each statement. Please attach additional paper if needed.

1=Strongly Agree 2=Agree 3=Disagree 4=Strongly Disagree

Regarding the Teacher Checklist only:

1. The information from the checklist is understandable.
(1) 2 3 4

Comments_____

_____

2. The information from the checklist is practical. I can see implementing these ideas into my existing curriculum.
(1) 2 3 4

Comments_____

_____

Regarding the Brain-Based Curriculum Unit Sample:

3. The information from the unit outline is understandable.

(1) 2 3 4

Comments _____

_____

4. The information from the unit outline is practical. I can see implementing these ideas into my existing curriculum.

(1) 2 3 4

Comments _____

_____

Regarding the Student Questionaire:

5. The questions on the questionnaire are at the student's level.

(1) 2 3 4

Comments _____

_____

6. The questions on the questionnaire are understandable.

(1) 2 3 4

Comments _____

_____

7. The questions, in your opinion would yield valid results on the student's reaction towards brain-based learning.

(1) 2 3 4

Comments _____

_____

Regarding the Teacher Checklist, Brain-Based Curriculum Unit Outline, and Student Questionaire as a combined document:

8. The combined documents provides me with new information about how learning occurs and offers effective brain-based learning strategies.

(1) 2 3 4

Comments_____

_____

9. The combined documents promotes creativity in teaching and in learning.

(1) 2 3 4

Comments_____

_____

10. The combined documents provides the means for a interconnected and interdisciplinary brain-based curriculum.

(1) 2 3 4

Comments_____

_____

Additional Information:

11. The most helpful part of the combined documents is _____ because

The teacher checklist assisted me in planning a brain-based unit.

_____

_____

_____

12. If I could add or delete to any part of the checklist, curriculum unit outline, or student questionnaire, I would add _____ because

I would not change anything, you did a good work

_____

_____

_____

Thank you for completing and returning this evaluation!

STUDENT QUESTIONAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.	X			
2. The assignments/projects were easy to understand.	X			
3. This unit was very stressful in terms of assignments/projects.				X
4. This unit was very stressful in terms of test taking/assessments?				X
5. It was easier to understand the concepts being taught in this unit compared to earlier units.	X			
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?	X			
7. You had less anxiety during this unit in comparison to previous units.	X			
8. You had some confusion as to what your role was in the learning process.			X	
9. You were given clear expectations (rubrics) for your assignments and assessments.	X			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.	X			
11. I feel I benefited greatly from this type of learning process.	X			
12. I would like to see other subject units set up in the same manner as this unit.	X			

COMMENTS:

I FELT LIKE I LEARNED MORE IN THE CLASS THAN I HAVE IN OTHER BORING CLASSES.

Please check which of the following activities you enjoyed most during this unit?

Journaling	X
Portfolios (learning logs)	
Guided imagery	
Collaborative groups	X
Planning unit	X
Creating bulletin boards	
Completing power point presentations as a partnership	
Group internet searches	X
Integration of Art into unit	
Group and partner laboratory experiences	X
Outdoor classroom (going outside to observe, collect samples, and experiment).	X

Please rate the importance of these factors in your opinion which were conducive to your learning:

1= Very important 2= Important 3= Somewhat important 4= Not important

	1	2	3	4
1. Adequate and natural lighting.			X	
2. Comfortable room temperature.		X		
3. Your class work is displayed in the classroom.		X		
4. Learning opportunities are challenging.				
5. Individual differences being respected and valued.	X			
6. Decreased stress level in class (elimination of pop quizzes, competitive grading).	X			
7. Variety of technology resources	X			

(computer, internet, LCD projectors, smart board, net television, etc.).				
8. Being able to participate in planning criteria and scheduling projects and assessments	X			

STUDENT QUESTIONAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.	X			
2. The assignments/projects were easy to understand.	X			
3. This unit was very stressful in terms of assignments/projects.				X
4. This unit was very stressful in terms of test taking/assessments?				X
5. It was easier to understand the concepts being taught in this unit compared to earlier units.	X			
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?	X			
7. You had less anxiety during this unit in comparison to previous units.	X			
8. You had some confusion as to what your role was in the learning process.		X		
9. You were given clear expectations (rubrics) for your assignments and assessments.	X			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.	X			
11. I feel I benefited greatly from this type of learning process.	X			
12. I would like to see other subject units set up in the same manner as this unit.				

COMMENTS:

I LOVE NOT HAVING TO TAKE TESTS!

Please check which of the following activities you enjoyed most during this unit?

Journaling	X
Portfolios (learning logs)	
Guided imagery	X
Collaborative groups	X
Planning unit	X
Creating bulletin boards	X
Completing power point presentations as a partnership	X
Group internet searches	X
Integration of Art into unit	X
Group and partner laboratory experiences	X
Outdoor classroom (going outside to observe, collect samples, and experiment).	X

Please rate the importance of these factors in your opinion which were conducive to your learning:

1= Very important 2= Important 3= Somewhat important
4= Not important

	1	2	3	4
1. Adequate and natural lighting.		X		
2. Comfortable room temperature.		X		
3. Your class work is displayed in the classroom.		X		
4. Learning opportunities are challenging.		X		
5. Individual differences being respected and valued.	X			
6. Decreased stress level in class (elimination of pop quizzes, competitive grading).	X			
7. Variety of technology resources	X			

(computer, internet, LCD projectors, smart board, net television, etc.).				
8. Being able to participate in planning criteria and scheduling projects and assessments	X			

STUDENT QUESTIONAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.			X	
2. The assignments/projects were easy to understand.		X		
3. This unit was very stressful in terms of assignments/projects.				X
4. This unit was very stressful in terms of test taking/assessments?			X	
5. It was easier to understand the concepts being taught in this unit compared to earlier units.	X			
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?		X		
7. You had less anxiety during this unit in comparison to previous units.	X			
8. You had some confusion as to what your role was in the learning process.		X		
9. You were given clear expectations (rubrics) for your assignments and assessments.	X			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.		X		
11. I feel I benefited greatly from this type of learning process.	X			
12. I would like to see other subject units set up in the same manner as this unit.		X		

COMMENTS:

I DON'T USUALLY HAVE FUN IN CLASS CUZ IT IS TOO SERIOUS. This class was fun!

Please check which of the following activities you enjoyed most during this unit?

Journaling	X
Portfolios (learning logs)	
Guided imagery	
Collaborative groups	
Planning unit	
Creating bulletin boards	
Completing power point presentations as a partnership	
Group internet searches	
Integration of Art into unit	
Group and partner laboratory experiences	
Outdoor classroom (going outside to observe, collect samples, and experiment).	X

Please rate the importance of these factors in your opinion which were conducive to your learning:

1= Very important 2= Important 3= Somewhat important 4= Not important

	1	2	3	4
1. Adequate and natural lighting.	X			
2. Comfortable room temperature.	X			
3. Your class work is displayed in the classroom.	X			
4. Learning opportunities are challenging.	X			
5. Individual differences being respected and valued.	X			
6. Decreased stress level in class (elimination of pop quizzes, competitive grading).	X			

7. Variety of technology resources (computer, internet, LCD projectors, smart board, net television, etc.).	X			
8. Being able to participate in planning criteria and scheduling projects and assessments	X			

STUDENT QUESTIONAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.		X		
2. The assignments/projects were easy to understand.	X			
3. This unit was very stressful in terms of assignments/projects.				X
4. This unit was very stressful in terms of test taking/assessments?				X
5. It was easier to understand the concepts being taught in this unit compared to earlier units.	X			
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?	X			
7. You had less anxiety during this unit in comparison to previous units.	X			
8. You had some confusion as to what your role was in the learning process.		X		
9. You were given clear expectations (rubrics) for your assignments and assessments.	X			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.			X	
11. I feel I benefited greatly from this type of learning process.	X			
12. I would like to see other subject units set up in the same manner as this unit.	X			

COMMENTS:

_____

_____

_____

_____

Please check which of the following activities you enjoyed most during this unit?

Journaling	X
Portfolios (learning logs)	X
Guided imagery	X
Collaborative groups	X
Planning unit	X
Creating bulletin boards	X
Completing power point presentations as a partnership	X
Group internet searches	X
Integration of Art into unit	X
Group and partner laboratory experiences	X
Outdoor classroom (going outside to observe, collect samples, and experiment).	X

Please rate the importance of these factors in your opinion which were conducive to your learning:

1= Very important 2= Important 3= Somewhat important 4= Not important

	1	2	3	4
1. Adequate and natural lighting.	X			
2. Comfortable room temperature.	X			
3. Your class work is displayed in the classroom.		X		
4. Learning opportunities are challenging.	X			
5. Individual differences being respected and valued.	X			
6. Decreased stress level in class (elimination of pop quizzes,	X			

competitive grading).				
7. Variety of technology resources (computer, internet, LCD projectors, smart board, net television, etc.).	X			
8. Being able to participate in planning criteria and scheduling projects and assessments	X			

STUDENT QUESTIONAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.	X			
2. The assignments/projects were easy to understand.			X	
3. This unit was very stressful in terms of assignments/projects.			X	
4. This unit was very stressful in terms of test taking/assessments?			X	
5. It was easier to understand the concepts being taught in this unit compared to earlier units.		X		
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?	X			
7. You had less anxiety during this unit in comparison to previous units.		X		
8. You had some confusion as to what your role was in the learning process.			X	
9. You were given clear expectations (rubrics) for your assignments and assessments.	X			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.	X			
11. I feel I benefited greatly from this type of learning process.	X			
12. I would like to see other subject units set up in the same manner as this unit.	X			

COMMENTS:

_____

_____

_____

_____

Please check which of the following activities you enjoyed most during this unit?

Journaling	
Portfolios (learning logs)	
Guided imagery	
Collaborative groups	X
Planning unit	X
Creating bulletin boards	X
Completing power point presentations as a partnership	
Group internet searches	X
Integration of Art into unit	
Group and partner laboratory experiences	X
Outdoor classroom (going outside to observe, collect samples, and experiment).	X

Please rate the importance of these factors in your opinion which were conducive to your learning:

1= Very important 2= Important 3= Somewhat important 4= Not important

	1	2	3	4
1. Adequate and natural lighting.	X			
2. Comfortable room temperature.	X			
3. Your class work is displayed in the classroom.				
4. Learning opportunities are challenging.		X		
5. Individual differences being respected and valued.	X			
6. Decreased stress level in class (elimination of pop quizzes,	X			

competitive grading).				
7. Variety of technology resources (computer, internet, LCD projectors, smart board, net television, etc.).	X			
8. Being able to participate in planning criteria and scheduling projects and assessments	X			

STUDENT QUESTIONAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.	X			
2. The assignments/projects were easy to understand.	X			
3. This unit was very stressful in terms of assignments/projects.				X
4. This unit was very stressful in terms of test taking/assessments?				X
5. It was easier to understand the concepts being taught in this unit compared to earlier units.	X			
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?		X		
7. You had less anxiety during this unit in comparison to previous units.	X			
8. You had some confusion as to what your role was in the learning process.		X		
9. You were given clear expectations (rubrics) for your assignments and assessments.	X			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.		X		
11. I feel I benefited greatly from this type of learning process.	X			
12. I would like to see other subject units set up in the same manner as this unit.	X			

COMMENTS:

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Please check which of the following activities you enjoyed most during this unit?

Journaling	X
Portfolios (learning logs)	X
Guided imagery	X
Collaborative groups	X
Planning unit	X
Creating bulletin boards	X
Completing power point presentations as a partnership	X
Group internet searches	X
Integration of Art into unit	X
Group and partner laboratory experiences	X
Outdoor classroom (going outside to observe, collect samples, and experiment).	X

Please rate the importance of these factors in your opinion which were conducive to your learning:

1= Very important 2= Important 3= Somewhat important 4= Not important

	1	2	3	4
1. Adequate and natural lighting.	X			
2. Comfortable room temperature.		X		
3. Your class work is displayed in the classroom.	X			
4. Learning opportunities are challenging.	X			
5. Individual differences being respected and valued.	X			
6. Decreased stress level in class (elimination of pop quizzes,	X			

competitive grading).				
7. Variety of technology resources (computer, internet, LCD projectors, smart board, net television, etc.).	X			
8. Being able to participate in planning criteria and scheduling projects and assessments	X			

STUDENT QUESTIONAIRE

Directions: Please indicate the extent to which you agree with the following statements. If you have any comments please write them in the "comments" area.

1= Strongly agree 2= Agree 3= Disagree 4= Strongly disagree

	1	2	3	4
1. I enjoyed the unit lessons being taught.	X			
2. The assignments/projects were easy to understand.	X			
3. This unit was very stressful in terms of assignments/projects.				X
4. This unit was very stressful in terms of test taking/assessments?				X
5. It was easier to understand the concepts being taught in this unit compared to earlier units.		X		
6. The cooperative/collaborative group that you were in was effective in helping you understand the concepts being addressed?		X		
7. You had less anxiety during this unit in comparison to previous units.	X			
8. You had some confusion as to what your role was in the learning process.		X		
9. You were given clear expectations (rubrics) for your assignments and assessments.	X			
10. Journaling and reflecting on your learning experiences benefited you in learning concepts.	X			
11. I feel I benefited greatly from this type of learning process.	X			
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Integration of Art into unit	X
Group and partner laboratory experiences	X
Outdoor classroom (going outside to observe, collect samples, and experiment).	X

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2. Comfortable room temperature.		X		
3. Your class work is displayed in the classroom.		X		
4. Learning opportunities are challenging.		X		
5. Individual differences being respected and valued.		X		
6. Decreased stress level in class (elimination of pop quizzes,	X			

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Outdoor classroom (going outside to observe, collect samples, and experiment).	X

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6. Decreased stress level in class (elimination of pop quizzes, competitive grading).	X			

7. Variety of technology resources (computer, internet, LCD projectors, smart board, net television, etc.).	X			
8. Being able to participate in planning criteria and scheduling projects and assessments	X			

STUDENT QUESTIONAIRE

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8. Being able to participate in planning criteria and scheduling projects and assessments	X			

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